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The Institute of Vitreous Enamellers
The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

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National Ironfounding Employers' Federation.
British Ironfounders' Association.
National Association of Malleable Ironfounders.
Ironfounders' National Confederation.
British Bath Manufacturers' Association.
British Malleable Tube Fittings Association.
Cast Iron Chair Association.
British Malleable Tube Fittings Manufacturers' Association.
Cast Iron Heating, Boiler, and Radiator Manufacturers' Association.
Cast Iron Segment Association.
National Ingot Mould Association.
British Cast Iron Research Association (affiliated).

A National Voice

THE FOUNDRY TRADE JOURNAL has received the signal honour of being appointed the Official Organ of the Council of Ironfoundry Associations, the most comprehensive body ever organised within the foundry industry. This qualification will receive ready acceptance, after reading the imposing lists of constituent bodies printed overleaf. The chairman is Mr. FitzHerbert Wright, until recently Director of Iron Castings, Iron and Steel Control, Ministry of Supplies; the executive and finance committees are made up of three vice-chairmen: Mr. W. R. Blair, Director of the British Ironfounders' Association (for light castings); Mr. J. D. Carmichael, president of the National Ironfounders' Employers' Federation for Heavy Castings, and Major Francis Ley, of the National Association of Malleable Ironfounders, together with Mr. V. Jobson, of the Ironfounders' National Confederation; Mr. P. L. Gould, of the N.I.E.F.; Mr. A. Watson, of the Cast Iron Segment Association; Dr. J. E. Hurst, representing the British Cast Iron Research Association, and Mr. V. Delport, Secretary. It will be noted that there are three affiliated associations, the Institute of British Foundrymen, the B.C.I.R.A., and the Engineering and Allied Employers' Federation. The object of including the research and technical organisations is fairly obvious, for, as has only been too tardily recognised in Governmental circles, scientific and technical thought is of fundamental importance in the conduct of modern affairs. The affiliation of the Engineering and Allied Employers' National Federation has come about because many large engineering firms possess foundries as a department of their works and do not feel that they can join an employers' association for only a section of their activities. Yet being profoundly affected by the impact of wartime legislation, they now possess a channel through which their views can reach the nerve-centre of the ironfoundry industry. It should be clearly understood at this stage that negotiations as to the working conditions within the industry are not included in the scope of the Association.

Another factor to be noted is that there is to be no *direct* representation on the Council of Ironfoundry Associations, but only indirectly through the participating associations, and here indeed is a wide choice. The N.I.E.F. is in itself a federation of a number of district associations, which permits of geographical representation. Should a concern dislike this mode, it can join up with the I.N.C., which includes a number of such foundries together with the geographically isolated ones. Finally, there is a fair selection of groups engaged upon the manufacture of specialities. There remains now not a single reason why every ironfoundry in the country, large or small, attached or unattached, should not support the entirely unselfish efforts which are being made to protect its interests, whilst still doing everything possible to help along the war effort. The new system it will be noticed gives a dual service, for it combines the advantages to be gained from joining any one of the associations listed, together with an assurance that the major problems arising out of the applications of Government orders, such as concentration of industries, labour supply, the various distribution schemes, wartime building regulations, and so forth, will be dealt with by a body—helped by professional advice if need be—built up upon the widest possible base. Firms remaining outside the organisation will receive from their colleagues—as they will well merit—the appellation of "mean," for those responsible for the conduct of the Council rightly put the country's needs—not necessarily bureaucratical interpretation—first, and the welfare of the foundry industry next, with special attention to individual hardships, and moreover are doing this as public-spirited people.

This triumvirate of Industry, Technology and the Press represents the consummation of a campaign we have been conducting in these columns for close on two decades. An instrument has been created, which properly used and enthusiastically supported by every ironfoundry concern is capable of insuring equity to and within the industry; immense commercial and technical progress; a measure of financial stability, and better working conditions. Finally, to those few firms still unrepresented, we ask in all sincerity to give the new Council a sporting chance of achieving its laudable ambitions.

Contents

	PAGE
A National Voice	231
Harnessing Copper Supplies	232
The Council of Ironfoundry Associations	232
Notes from the Branches	232
Random Shots	232
Institute of Vitreous Enamellers	232
World Heat and Power Requirements and their Social Implications	233
The Disadvantage of Short Core Prints	234
Book Reviews	234
Melting in the Cupola	235
Indo-China Wolframite	237
Mass Production and Maintenance of Quality	238
Science and World Order	242
Uses of Strontium in Metallurgy	242
A Watt Beam Engine Ceases Operation	242
The Week's News in Brief	244
Personal	244
Obituary	244
Law Report	244
Contracts Open	244
Raw Material Markets	246
Reports and Dividends	246

Harnessing Copper Supplies

By "ONLOOKER."

It is curious to reflect that after the fall of France, not much more than a year ago, copper prices weakened in New York through fears that disposal of all the metal available would be difficult. Chile looked like being gravely affected, and indeed for some time copper did accumulate in that country in spite of the fact that at that time exports to Japan were still permitted. There were outstanding in the middle of last year, when France gave up the fight, contract balances on contracts placed with the United States, but it is generally supposed that these were taken over by the British Ministry of Supply. Even so there was a sharp drop in demand, and across the Atlantic one heard talk of production being curtailed if matters did not improve. That improvement came when changing sentiment decreed that the United States should give greater help to Britain, and should moreover strengthen her own position both on the military and naval side. At the same time the output of aeroplanes was speeded up, but this affected aluminium and magnesium much more than copper and zinc. Thus the movement away from commercial enterprise in the direction of a large wartime production was begun, but it is only now that the onesidedness of the national programme in America is beginning to affect seriously the outlook for supplies to the public.

Priorities Established

So far removed is the present American copper situation from that ruling in the summer of 1940 that the authorities in the States are going to considerable lengths to augment a domestic production programme which has already been stretched to the utmost in an attempt to cope with the ever increasing needs of an expanding munitions output while at the same time looking after commercial requirements. It has, of course, been realised that somebody had to give away, and John Citizen is the one who must in future face up to the paramount needs of fighting services, both American and Allied. A system of strict and effective priorities covering the use of copper has been adopted, as a result of which a proper perspective ought to be established and maintained throughout the whole of the metal industry of America. In Britain the public has travelled a long way along that road, for it was in September, 1939, that the licensing system now in operation was adopted, and it is not untrue to say that the net of the Control is far flung and drawn tight so that the "black market" in copper, if one exists at all, inflicts but very small damage on the war effort.

Perhaps one of the outstanding achievements of the war in the realm of commodities has been the successful control of the sterling price of copper at a level, but little more than one-third of that during the last war. Undoubtedly the lead given by the British Ministry of Supply has been followed by the U.S. government, and if 12 cents is not the exact parity of £62, it is yet of the same order of valuation, and far removed from the spectacular levels foreseen at one time by certain ultra bullish onlookers and minor prophets on the other side of the Atlantic. True there is a likelihood of a 1 cent subsidy for some high cost Michigan mines, but this really underlines the determination of the authorities at Washington to block the path to inflation. British consumers have enjoyed the unusual experience of a run of price stability nearly two years in length, which does not at the moment show any signs of going back on them, and moreover copper stands at a level which in view of the present rate of world demand must be regarded as cheap. Copper to-day held in excess of commitments is certainly "at risk," but the risk is not onerous.

The Council of Ironfoundry Associations

This new body is a council constituted from representatives of the following bodies:—

National Ironfounding Employers' Federation;
British Ironfounders' Association;
National Association of Malleable Ironfounders;
Ironfounders' National Confederation;
British Bath Manufacturers' Association;
British Malleable Tube Fittings Association;
Cast Iron Chair Association;
Cast Iron Heating, Boiler and Radiator Manufacturers' Association;
Cast Iron Segment Association;
National Ingot Mould Association;
British Cast Iron Research Association (affiliated).

The objects of the Council are:—"The industry with which the Council is concerned is the manufacture of all classes of iron castings, including malleable-iron castings. The Council should act on the governing principle of the complete autonomy of each association within its own field or its own branch of the industry and the Council shall act for the industry as a whole as and when it becomes necessary on all matters relating to Government action or negotiation, or other matters of general importance."

There is also the practical assurance that the Greensand Pipe Founders' Association of Scotland, the Institute of British Foundrymen, and the Engineering and Allied Employers' National Federation—the last two as affiliated members—will join, as there remains in these cases acceptance to be passed by their respective councils or executive committees. Moreover, negotiations are in progress with several specialised associations from which there is every hope of adherence. Any founder in difficulty in connection with the application of Government orders should write immediately to his association, and if the matter shows it to be of general interest it will be handled by the Council. Foundry concerns can only obtain membership of the Council, and therefore its assistance, by joining one of the participating associations. The fullest particulars and disinterested advice can be had by writing to the secretary of the Council at 2, Caxton Street, Westminster, London, S.W.1. The telegraphic address is "Irotrapen, Parl, London," and the telephone number Whitehall 2743.

Notes from the Branches

West Riding of Yorkshire.—The opening meeting of the session is to be held next Saturday at 5 p.m. at 1, Manville Terrace, Bradford (opposite the Technical College), when Mr. W. Fearnside will deliver his presidential address, after acting as host at an informal tea-party. It has been arranged for the greater part of the session to be devoted to the discussions of Papers dealing with the production of a specimen casting—one meeting to be allotted to each of five sections: Moulding; Core-making; Metal and Melting Practice; Possible Defects in the Casting; and How Science could help or improve on the methods discussed. After the presidential address there will be an opportunity for members to express their views on this matter, and the Branch Council would welcome any suggestion which would add to the interest or usefulness of this series of discussions.

London.—The next meeting is to be held at 2.30 p.m. at the National Liberal Club, S.W.1., on November 8, when Dr. A. B. Everest has promised to give a talk on "Recent Developments in Cast Iron in the U.S.A." For the December meeting, the date of which is not

(*Continued in next column.*)

Random Shots

It is a common trait in human character to marvel at magnitude, be it of an undertaking (such as the overthrow of Nazism) or be it of something more tangible and visible, like the Pyramids or an anvil block casting for a steam hammer. Miniatures, on the other hand, are so small as to be passed by unnoticed unless their very minuteness imparts to them an unusual effect of daintiness and delicacy. The Queen's doll's house provides a good example of how the public imagination was for once in a way fired by the exquisite beauty of miniature workmanship. It must be admitted, however, that magnitude is the favourite appeal of the moment. A large steak, for instance, gives more satisfaction than a "*steak minute.*" And who, seeing a row of those baby size liqueurs and spirits once so fascinating to behold, and a row of full sized bottles of the same potations, would covet the former rather than the latter?

* * *

Nevertheless, exceedingly small objects have an equal claim to fame as the exceedingly great, for exactly as one wonders how the Pyramids could have been constructed so tremendous, so does one marvel that the exceedingly small can be fashioned by human fingers or even more so by mechanical means. At this very moment "Marksman" is marvelling at a handful of castings which have been sent from a foundryman in Yorkshire; castings which must surely rank as amongst the smallest in present production, it taking at least 52 of them to turn the scales at an ounce! These tiny boot protectors are cast in rows down either side of a central stem, which, before they are detached, gives a delicate leaf-like formation to the casting. As the accompanying letter points out, "tha's got to be 'wick' to see 'em, let alone mak' 'em." There is, to crown all, a name actually cast into each segment!

* * *

They do say in Yorkshire, especially in the district in which these castings are made, that hawkers and ice-cream sellers shun the district like a plague because of the nasty little habit their thin motor tyres have of picking up these boot protectors. Even the young ladies of the district are supposed to carry handbags fitted with farrier's knives for extracting such pick-ups from their shoes. But, of course, it is well known that a Yorkshireman is the equal of an Aberdonian at telling a good tale against himself.

* * *

The best crossword clue of the week comes from the "Times":—

Clue: The price of French tennis.
Answer: Lacoste.

"MARKSMAN."

Institute of Vitreous Enamellers

A meeting of the Southern Section of the Institute of Vitreous Enamellers will be held on October 18 at 10 a.m. at 49, Wellington Street, Strand, London, W.C.2. Since individual notices may not be sent, members are requested to act on this notice, as important decisions are to be taken.

(*Concluded from preceding column.*)

fixed, there is the promise of a Paper on "Tin Bronzes" from Dr. W. T. Pel-Walpole, whilst in January there is to be a cine-talk on the "Gating of Castings," by Mr. E. M. Currie, director of the International Meehanite Metal Company, Limited. The February meeting will hear a Paper from Mr. E. R. Francis, B.Sc. (assistant editor of the "Foundry Trade Journal"), on "Metallurgical Knowledge: Its Publication and Diffusion."

World Heat and Power Requirements and their Social Implications*

By SIR HAROLD HARTLEY, F.R.S., Chairman of the Fuel Research Board

Any discussion of the relation between science and human needs must include the world requirements of heat and power, since the utilisation of the free energy of coal was the fundamental factor in the Industrial Revolution which changed social conditions so profoundly. It is no exaggeration to say that without the successive developments that have made available heat and power most of the scientific discoveries of the last 200 years could not have made an effective contribution to the progress of civilisation. The milestones were James Watt's improvements of the steam engine in 1769, Fulton's steamship in 1807, the birth of the gas industry and the distribution of energy in 1807, Stephenson's Rocket in 1829, Faraday's discovery of electromagnetic induction in 1831 which culminated in the first power station fifty years later, Otto's internal combustion engine in 1876, the Swan Edison lamp in 1879, Parson's invention of the steam turbine in 1884, and the Wrights' first flight in 1903.

The main results of this progressive utilisation of energy were:—

(1) Power driven machines with a continuous increase in the productivity of labour and material resources, first in industry and later in agriculture.

(2) Means of rapid transport by land, sea and air, facilitating the development of new countries, making available the world resources of raw materials and food, and providing new markets for industry.

(3) The development of metallurgical and chemical industries, producing secondary raw materials for industry and fertilisers for agriculture.

(4) The high voltage distribution of electricity making possible the dispersal of industry and thus avoiding the overcrowding of urban areas.

Energy and Standards of Living

Following on these results of the applications of energy in industry and agriculture has come another revolution no less far-reaching, the Domestic Revolution—the scientific application of heat and power in the home, which has done so much in this century to raise the standard of health and comfort. It may be regarded as the repayment by the technician of a deferred debt long overdue for some of the social consequences of the mechanisation of industry in the nineteenth century.

Since the utilisation of energy has played such a vital part in increasing productivity and the standard of living in the past, it should be an equally important factor in the period of reconstruction for which we now have to plan. The achievements of power are too often dismissed with picturesque phrases without quantitative consideration, and this Paper is a plea for a detailed consideration on a quantitative basis of the energy problems and possibilities involved in any schemes of reconstruction—world energy resources, their utilisation and conservation. Much material is already available for such studies in publications of the League of Nations and various governments, in the investigations of bodies such as the National Industrial Conference Board, and particularly in the Statistical Yearbooks of the World Power Conference and in the Transactions of its Meetings, which contain reports on most aspects of energy problems submitted by the National Committees of over forty countries. Much remains to be done to make these statistics more complete and informative, but they are an indispensable basis for planning the future.

Growth of World Energy Requirements

From 1820 to 1900 the world annual consumption of coal showed a steady logarithmic increase from 20 to 778 million tons, and in 1936 the world requirements of energy, apart from that supplied by human and animal labour, were met by burning approximately 1,400 million tons of coal, 240 million tons of oil, 400 million tons of wood, 50 million tons of natural gas, and generating 130,000 million units of hydro-electricity. The proportionate contributions of useful energy from each of these sources, assuming an average efficiency of 50 per cent. for fuel and 90 per cent. for electricity, were coal 63 per cent., oil 18 per cent., wood 12 per cent., natural gas 5 per cent. and water power 2 per cent. If all the potential water resources of the world had been harnessed—and many of them lie in remote regions—their maximum contribution has been estimated at from 15 to 30 per cent. of the world's requirements, so it is clear that the burning of fuel must continue to supply the greater part of the world's energy consumption until other means have been discovered of utilising the sun's radiation. About 60 per cent. of the world coal production is ultimately used in the form of heat and 40 per cent. in the form of power. At the present rate of consumption the world coal reserves including lignite would be sufficient on an average for 4,000 years, those of Great Britain for 750 years and of the United States of America for 6,000 years. No estimate has been made of the world's oil reserves, although they are almost certainly much less extensive than coal.

But this is no time for complacency because of the improved standards in the industrialised countries, as even there the irregularities are great and we must remember that the steady improvement of conditions in the nineteenth century took place under the stimulus of the rapid development of virgin countries, suitable for European immigrants, and of rapidly increasing population—a phase which ended by 1900. It is pertinent to ask how far the lack of adjustment to the "closing of the frontier" is responsible for the economic vicissitudes of the twentieth century. The majority of the inhabitants of the world are still living on a miserably poor level, far below what we have come to regard as the minimum of physiological requirements.

Reconstruction Problems

What can science do through the utilisation of energy to help to solve the immediate problem of reconstruction, and what are the long range problems in this field? The immediate problem is to raise the world's productivity, particularly in the backward countries, and to secure the equitable distribution of the products in relation to the needs of each country, thereby eliminating the waste of energy involved in the search for self-sufficiency within arbitrary geographical boundaries. The initial stimulus must come from the technical resources of the developed countries, and may entail a quick and lavish expenditure of energy and resources. But in replanning conservation must be the guide, for in spite of the large world resources of fuel, these will become increasingly more inaccessible. They are of widely different types and we must avoid exhausting prematurely those of special character, such as caking coal. The Soviet Government has already taken effective steps to safeguard this key fuel.

The energy problems in the developed countries are relatively clear and simple, and technological progress will continue to solve them. Maximum economies must be obtained in the winning and distribution of fuel, and in its utilisation, with the constant objective of making energy cheaper and more generally available. But the generation of electricity by means of condensing turbines must always involve considerable heat losses. One remedy for this is regional planning with a view to securing as far as possible the joint use of heat and power, the heating being done by steam extracted from the turbine after partial expansion, thus saving the losses due to condensation. The carbonisation of raw coal and the use of electricity in some co-ordinated scheme, designed to secure the maximum advantages from both, will help to solve the problem of smokeless cities, and will provide the cheap energy needed in the homes of the future.

One of the major problems of developed countries is the inequality of conditions in the town and country. Agriculture still retains much of its primitive character. Wider application of energy on the farm, and in conditioned transport and storage, would increase productivity, ease the conditions of life, and accelerate the processing of farm products, a development which is now in its infancy. Experience in Canada and in the United States has shown how much the tractor, the motor vehicle and electric power can contribute to higher standards on the farm. At present about 88 per cent. of the world's agricultural production (on a value basis) is used as food, 8 per cent. as textiles, and 4 per cent. in other industries, the last two together representing roughly one-third of the raw materials of industry. There is a growing tendency to look to agriculture for a larger proportion of these raw materials, but this must depend largely on processing and on the factory becoming an adjunct of the farm.

Position in Backward Countries

Over half the 2,000 million inhabitants of the world live in the less developed countries and depend mainly on agriculture. Their energy problems are much more urgent and more difficult. How can their standards be raised, and can they provide, with the aid of scientific development, the new outlets for world industry as the virgin countries did in the nineteenth century? The answer has been sketched by Prof. Noel Hall in his Memorandum to the League of Nations on Measures of a National and International Character for Raising the Standard of Living. In the most backward countries, where many millions are existing on subsistence agriculture isolated from any means of helping themselves, the first need is cheap transport, adapted to the needs and energy resources of the particular region. This would provide a means for the exchange of products and thus expand and diversify existence in primitive communities. The problem is really that of changing their mode of life and opening up for them new possibilities. With the stimulus of communication and the help of markets, demands will come gradually for simple implements and machines, fertilisers and the simpler amenities of life.

In the less primitive countries the problem becomes relatively easier, but the elements remain the same—improved transport and communications, better means of storage and marketing, power driven machinery, the processing of products, and every means of raising productivity without impairing the fertility of the land. In all these measures energy has a primary part to play, and by helping on the one hand to increase the output of agriculture and on the

(*Continued on page* 234.)

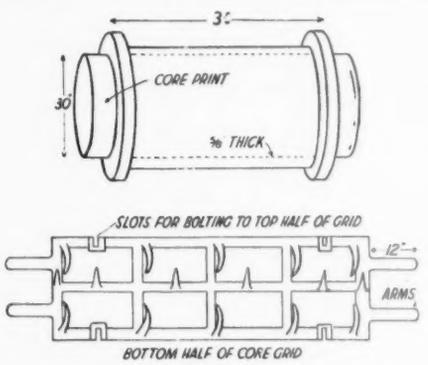
* Paper read at the second session of the British Association meeting: "Science and World Order," held at the Royal Institution, September 26, H.E. The American Ambassador, Mr. J. Winant in the chair.

The Disadvantage of Short Core Prints

By "W. G."

There are more reasons than one why it is good policy to ensure that core prints, especially on large patterns, are given plenty of length. Economy of timber in this respect should not be the deciding factor, for if a core print has to receive a heavy core, extra work and much annoyance will be experienced in the various operations of moulding. Therefore, a little study of the following article will reveal that there is no case for their recommendation, as the time and expense saved in the patternshop is twice expended in the foundry by the problem and risks they present to the foundryman. The attached sketch of a cast-iron pipe is an excellent example of short core prints being the cause of unnecessary labour and irritation.

It will be seen from the sketch that the length of the prints is only 3 in. instead of 12 in., with a diameter of 30 in. By the use of a barrel core, in which case any desired length could be struck up on the barrel, the short core prints would have presented no obstacles to the moulder, as he could have added to their length by rammed sand at each end of the prints corresponding to



Sketch of a Short Core Print of a Cast-Iron Pipe.

the length struck up on the barrel. A 6 ft. long core would thus allow enough bearing in the core prints without fear of crushing them. For certain reasons, however, this core was made in two halves of oil sand by means of a frame and strickle, each half carried by a strong core iron, shown in the lower drawing. After drying they were bolted together, each iron being provided with slot holes for the purpose.

The usual practice of bedding a 56-lb. weight under the core prints to take the weight of the core—in this case about 7 cwts.—was carried out, extra precaution being taken by placing a chaplet in the centre of the mould to act as additional bearing.

Further measures, other than the usual ones, had to be employed for holding down the core at the time of pouring, as the 3-in. prints were inadequate in length to leave sufficient freedom of action for this operation.

To overcome this difficulty without the use of chaplets in the top part of the mould, arms were cast on the bottom half of the core iron, thus providing ample length for scotching purposes after closing the moulds. Unusual care had also to be taken when stopping up the ends of the core, as a little extra pressure would result in pushing in the mould.

When taking measures to prevent a run-out at each end of the box, extra sand had to be used and rammed tight. With long core prints, these risks could have been quickly and easily eliminated.

Book Reviews

The Transactions of the Manchester Association of Engineers, 1940-41. Edited by T. Makemson and J. Bolton. Published by the Association from St. John Street Chambers, Deansgate, Manchester, 3.

Though the Transactions are perhaps a little thinner than in previous years, the standard in every other respect has been well maintained. If the Association has one outstanding characteristic it is its catholicity of taste in the matter of its choice of subjects for discussion. In this volume there are two Papers dealing with temperature—one covering automatic temperature control and the other, the measurement of temperature in machinery in motion. Only a précis of the sole Paper on foundry practice is given. It is a contribution by Mr. Frank Hudson on the subject of recent developments in cast non-ferrous engineering materials. Whilst the Transactions are distinctly the poorer by the absence of the full text, it so happens that the author is a prolific writer and his views and works are available elsewhere. Other subjects embraced in this book are the design and manufacture of small engineering apparatus; line production of machine tools; woodworking machinery; mechanical excavation; and wartime management. If members could not find something of value and real personal interest amongst such a variety of subjects, then indeed they must be working in a very restricted field of activity. V.C.F.

The Science and Practice of Welding. By A. C. Davies, B.Sc. Published by the Cambridge University Press, Bentley House, 200, Euston Road, London, N.W.1. Price 10s. 6d. net.

The reviewer once essayed to write a few articles on metallurgy for welding and found this no easy task, for it was extremely difficult to assess just how much science the average welder could with profit digest. Mr. Davies has well solved this problem and to take the student from iron ore, through martensite and austenite, to the light alloys in 64 pages, is indeed a masterpiece of compression. Yet, to the reviewer's mind, bearing in mind his ultimate circle of readers, there should have been given, preferably at the end of the chapter, a list of recommended books. This suggestion is based very largely as a result of studying pages 78 and 79—the most important of all from the point of view of helping the welder to understand his job. Here reference is made to the iron-carbon diagram, and whilst no mention is made of cementite, due prominence is given to troostite and sorbite, but the equilibrium diagram, perhaps reproduced on too small a scale, confines itself to ferrite, cementite, martensite and austenite. Even at a sacrifice of scientific exactitude, someone, sometime, must provide the welder with a simpler explanation than has yet been given. With these conclusions, there is reasonable certainty that the author will agree. What has been referred to is contained in Chapter II. It is preceded by an excellent chapter on welding science, and is a model on which ultimately the ideal welder's text book should be based—a difficult problem for solution. Chapter III is a well-balanced description of the practice of oxy-acetylene welding and it is followed by an equally good one describing the principles of electric welding. In the chapter on the gas cutting of iron and steel, so important to the steelfoundry industry, the reviewer would, in the interests of economy, like to have seen some reference to embrittlement of steel rails brought about through the partial cutting-through by the flame and the consequential ability—after a reasonable period—to break the uncut portion with a sledge hammer. Not only is gas thereby saved but a simple metallurgical explanation would be valuable. Chapter IV covers the important and still controversial subject of the inspection of welds. It might have been better to omit some of the photographs and descriptions of the commoner forms of testing machines as they are so easily available elsewhere, and utilise the space for the specialised equipment. The remainder of the normal methods of welding are covered in the penultimate chapter and finally the author has been wise to devote a section to the important subject of engineering drawing. There is, as seems to be the custom nowadays, an appendix to carry standardised tabular matter. It is a policy which has little to commend it and in this case some of it—the portion devoted to costing—could better have formed the subject of a separate chapter. Other parts could have been included in the body of the book and the balance omitted as being readily available elsewhere. To sum up the book as a whole, it can be stated that its study by welders will give them a good appreciation of the theory underlying their work, tell them of processes which they do not at the moment operate, but may be called upon to do so in the future, and indicate how their work is evaluated by the inspectorate. Moreover, the price for a wartime publication is very reasonable.

V.C.F.

Institution of Mechanical Engineers

Mr. W. A. Stainer will deliver his presidential address to the Institution of Mechanical Engineers on October 24. He will talk on "The Position of the Locomotive in Mechanical Engineering." The Thomas Hawksley lecture, "A Century of Travelling," by Mr. W. T. Halcrow, will be delivered on November 21. Papers on the hammer-blow on rails and the balancing of locomotive engines will be discussed at a joint meeting with the Institution of Civil Engineers on December 16. A Paper on "The Axial Vibration of Diesel Engine Crankshafts," by Mr. R. Poole, will be presented on December 19, in conjunction with the Internal Combustion Engine Group, and a Paper on "The Utilisation of Wood Refuse for Steam Raising," by Mr. R. B. Gillham, will be read on January 9, in conjunction with the Steam Group. At the annual general meeting, to be held on February 20, a Paper on "Mechanisation of Foundries in Europe" will be read by Mr. A. S. Beech.

World Heat and Power Requirements and their Social Implications

(*Concluded from page* 233.)

other to create fresh demands for industry, it can improve the standard of living in both, thereby easing the economic relations between agricultural and industrial regions.

Scientific Planning

These are the immediate problems which require rapid and intensive attack when reconstruction is possible. With the scientific knowledge we now possess of standards of consumption it should be possible to plan with much greater certainty than in the past. Meanwhile we can leave to fundamental research the longer range problems, confident that it will yield continuing improvements in the methods of utilising fuel, in the distribution and storage of electricity, in the uses of power, and in the production of substitutes for mineral oil from coal or vegetable products against a possible shortage. The ultimate goal is the utilisation of the sun's radiation currently by some photochemical or photoelectric device or engine to take the place of the solar energy stored in coal and oil. These are the long-range problems to be solved in the days to come when once more it can be said that science knows no frontiers. Her immediate task is to ensure that in the replanning of the world full use is made of the basic knowledge that she alone can provide, particularly in the fields of nutrition and energy with all that they imply for the well-being of mankind.

Melting in the Cupola

CONTINENTAL RESEARCH WORK SUMMARISED

By S. C. MASSARI and R. W. LINDSAY.

(*Continued from page* 220.)

Heat Balance and Thermal Efficiency

Heat balances were constructed for operating conditions involving use of a constant volume of blast (Fig. 9), a constant melting rate (Fig. 10) and a constant coke charge (Fig. 11). It should be noted that, when hotter iron is produced by using more coke, a poor thermal efficiency results (see Figs. 9 and 10). This fact is widely recognised. The ratio of the amount of heat absorbed by the iron to the total quantity of heat developed becomes progressively smaller with increasing coke charge. By comparison, increasing the iron temperature through the use of more blast with a constant coke charge does not appreciably affect thermal efficiency (Fig. 11).

Fig. 12 shows the thermal relationships with various blast volumes and different weights of carbon burned per hour. The diagram is practically self-explanatory. The heat content of the iron decreases as the coke charge becomes heavier in each instance, because the metal melted per hour will decrease under such conditions. The lowering of thermal efficiency by using more coke is also portrayed.

Jungbluth and Stablein do not think that thermal efficiency should be valued too highly as a criterion for cupola operation. They point out that sometimes it is necessary to operate with a reducing melting rate, which means operating with a fairly heavy coke charge and relatively low blast volume to obtain a requisite high iron temperature. Such conditions, of course, are associated with poor thermal efficiency. Furthermore, a consideration of thermal efficiency in itself does not give an accurate portrayal of the melting process as a whole.

Jungbluth and Stablein favour judging the cupola process on the basis of thermometric efficiency (n_T). Thermometric efficiency is evaluated by relating the absolute temperature of the molten iron (temperature in deg. C + 273) to the melting temperature of cast iron (1,145 deg. C. or 1,420 deg. absolute) as a reference point. Obviously, higher thermometric efficiencies will be associated with hotter iron. The thermometric efficiencies are plotted in Fig. 13 for two constant blast volumes with increasing coke charge. The thermal efficiencies (n_K) are also plotted for these same conditions.

A study of this diagram reveals that thermometric efficiency does furnish a better picture of the cupola process than does thermal efficiency. A consideration of thermometric efficiency immediately shows the temperature of the iron increases, as was shown in the previous discussion, when the coke charge is increased while the blast is held constant. Furthermore, it reveals that, for a given coke charge, the iron temperature increases with increased blast since a higher thermometric efficiency is associated with the greater of the two blast volumes. These fundamental facts of cupola melting are not shown by a study of thermal efficiency.

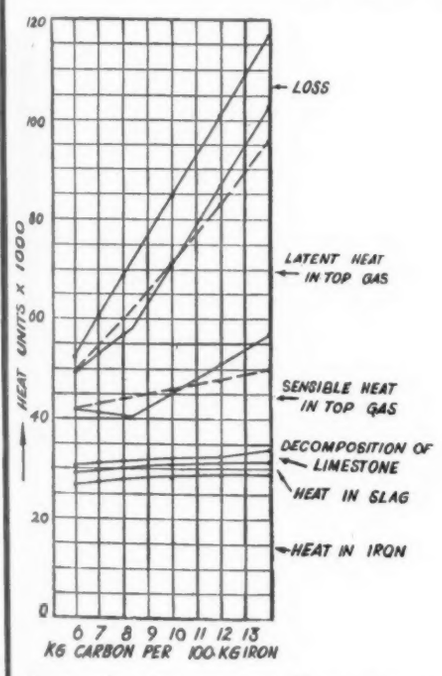


FIG. 9.—HEAT BALANCE FOR A 15 CUB. M. PER MIN. BLAST VOLUME, BASED ON 100 KG. IRON.

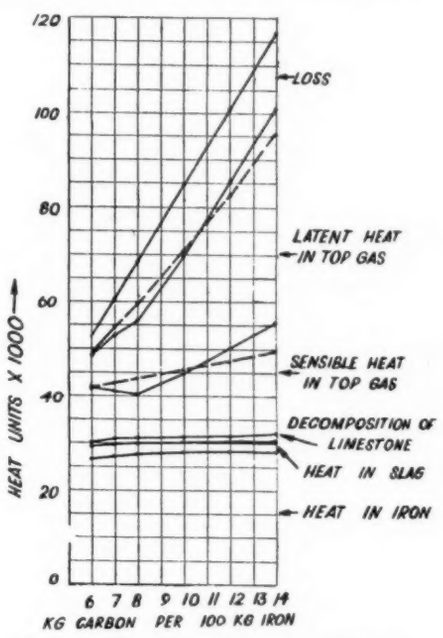


FIG. 10.—HEAT BALANCE FOR A MELTING RATE OF 2 TONS PER HR., BASED ON 100 KG. IRON.

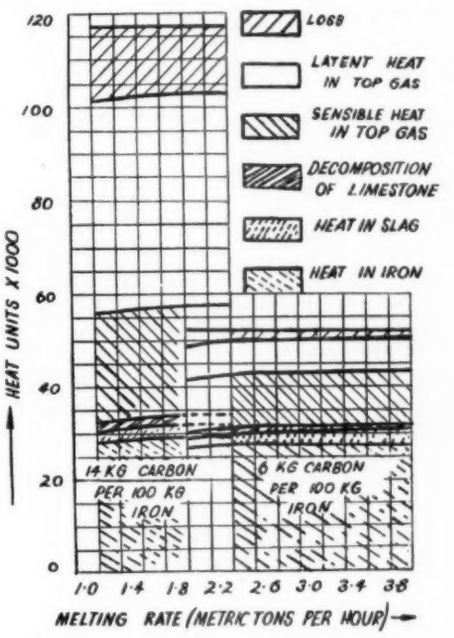

LOSS
LATENT HEAT IN TOP GAS
SENSIBLE HEAT IN TOP GAS
DECOMPOSITION OF LIMESTONE
HEAT IN SLAG
HEAT IN IRON
14 KG CARBON PER 100 KG IRON
6 KG CARBON PER 100 KG IRON
HEAT UNITS X 1000
MELTING RATE (METRIC TONS PER HOUR)

FIG. 11.—HEAT BALANCE FOR 14 OR 6 KG. OF CARBON PER 100 KG. IRON, BASED ON 100 KG. IRON.

Practical Considerations

The fact that the temperature of the iron rises with constant coke charge and increasing blast volume is attributed to the increased height of the incandescent zone. Consequently, a suitable cupola construction will involve contraction of this zone further to increase its height. It has been shown that preheating of the cold charges in the stack of the cupola is not an important factor in determining the ultimate temperature of the molten iron. However, this is only relatively true and substantial increase in the height of the cupola can be expected to show its effect. If the effective height of the cupola is noticeably increased, no doubt all curves in Fig. 7 will be displaced to the right. An increase in the diameter will act in the same direction, but not to such a large extent.

Raising the temperature of the iron by holding the blast constant and increasing the coke charge results in poor thermal efficiency. Therefore, cupola operators will generally seek to obtain increased temperature of the iron by increasing the incandescent zone, that is by utilising a greater blast volume.

A cupola may be considered to be "overfed" with coke, only if higher temperatures are sought using heavy coke charges, that can otherwise be obtained with lighter coke charges and greater blast volume. According to Jungbluth *et al.*, there is no lack of air in the cupola. The carbon monoxide which is present in the stack gas is not eliminated by increasing the blast, but is present as a result of the reduction of carbon dioxide by carbon in the upper coke charges. On the other hand, there is a strong possibility of excess air in cupola operation. However, if large quantities of oxygen are found in the effluent gases, it is logical to first make a rigorous search for possible errors in taking gas samples and running analyses. It may be that the source of excessive oxygen in the gases lies here and not in the operation of the cupola.

It is quite evident that the quality, or analysis, of the iron to be melted must be given close consideration when choosing the proper method for increasing the temperature of the iron. If a low-carbon, high-duty iron is being melted, increasing the blast is the only method available. The use of heavier coke charges leads to higher total carbon in the resulting iron. On the other hand, the coke can be increased without hesitation when melting higher total carbon iron. Raising the temperature of the iron by increasing the height or diameter of the shaft is limited in scope. Increasing the height may lead to "scaffolding" or hanging of the charges in the furnace. Increasing the diameter beyond a certain dimension may lead to difficulties resulting from poor blast penetration.

D

Melting in the Cupola

The results obtained in these investigations naturally apply only to the conditions prevailing during this investigation, but Jungbluth and his associates believe that the hypotheses which they have constructed are applicable to all cupola operations. Furthermore, with the use of still larger quantities of blast than were used in these investigations, the curves for constant coke charges will deflect to lower temperatures,

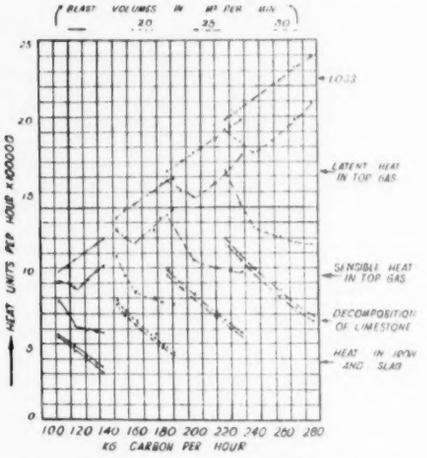

BLAST VOLUMES IN M³ PER MIN
20
25
30
LOSS
LATENT HEAT IN TOP GAS
SENSIBLE HEAT IN TOP GAS
DECOMPOSITION OF LIMESTONE
HEAT IN IRON AND SLAG
HEAT UNITS PER HOUR X 100000
0 5 10 15 20 25
100 120 140 160 180 200 220 240 260 280
KG CARBON PER HOUR

Fig. 12.—Disposition of Heat Produced v. the Quantity of Carbon Burned per hr. with Different Blast Volumes.

since the coke will be blown cold. An indication of this will be the appearance of noticeable quantities of oxygen in the top gas, giving definite evidence of excess air. No attempt should be made to extrapolate the curves in Fig. 2 to lower melting rates, since these experiments disclosed that considerable difficulties occurred with low coke charges and low blast volumes because of scaffolding of the charges.

Thermal efficiency should not be considered as representing the sole criterion for evaluating cupola operation. Sometimes a low melting

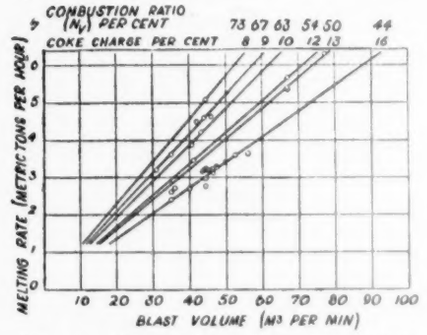

COMBUSTION RATIO
(nv) PER CENT
73 67 63 59 50 44
COKE CHARGE PER CENT
8 9 10 12 13 16
MELTING RATE (METRIC TONS PER HOUR)
0 1 2 3 4 5 6
10 20 30 40 50 60 70 80 90 100
BLAST VOLUME (M³ PER MIN)

Fig. 15.—Melting Rate, Coke Charge and Blast Volume.

rate is required, which necessitates operating with a poor thermal efficiency to produce hot iron.

Summary

The following hypothesis of operation was constructed to describe cupola melting: The blast introduced into the cupola burns the carbon in front of the tuyeres almost completely to carbon dioxide. The height of the zone of incandescence, therefore, is independent of the coke charge, and depends only upon the volume of blast used. Therefore, the incandescent zone is of uniform height with constant blast volume. A faster melting rate with constant coke charge and increasing blast volume results from the higher zone of incandescent coke associated with these conditions, and more coke burning in unit time, making it possible for the charges to descend more rapidly.

With constant blast and increasing coke charge, the added coke does not burn in the incandescent zone, but only serves to reduce part of the carbon dioxide formed in this zone to carbon monoxide. As the coke charge is increased, greater quantities of this "surplus

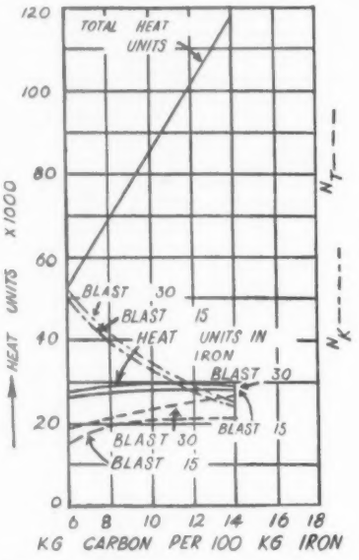


Fig. 13.—Thermal and Thermometric Efficiency of the Cupola.

coke" must be removed before the charges can reach the incandescent zone, and a reduction in the rate of melting occurs. An investigation of the temperature of the resulting iron and the construction of heat balances indicated that the hypothesis of operation developed is in agreement with the thermal data.

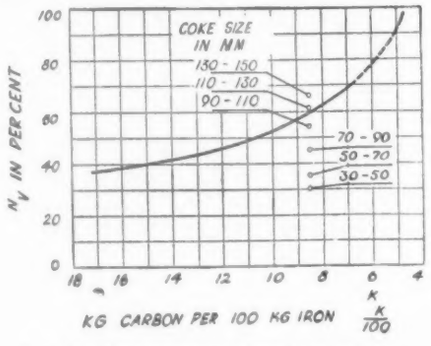


Fig. 16.—Influence of Coke Size upon N_V. (After G. Buzek and M. Czyzewski.)

APPENDIX

Mathematical Treatment of Cupola Melting

G. Buzek,[3] as early as 1910, showed that the melting rate could be expressed mathematically in terms of the blast volume, coke charge, and the air consumed per kilogram (2.2 lbs.) of carbon as:—

$$(1) \qquad S = 600 \times \frac{W}{L \times K \times k} \text{ wherein,}$$

S = the quantity of iron melted per hour in metric tons (1 metric ton = 1,000 kg. = 2,200 lbs.),

W = the volume of blast per minute in m³ (1 cub. m. = 35.29 cub. ft.),

L = the quantity of air consumed per kilogram of carbon in cubic metres.

K = the quantity of coke in kilograms used for melting per 100 kilograms of iron, and

k = the quantity of carbon contained in 100 kilograms of coke (per cent. carbon in coke × 100).

In this equation the number "600" represents a simple weight and time conversion.

The quantity of air actually consumed per kilogram of carbon (L) can be computed if the

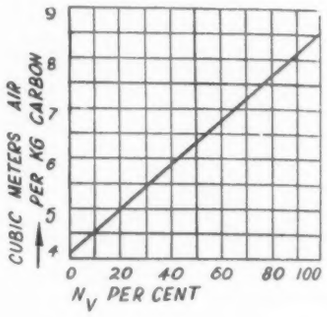


Fig. 14.—Relation between N_V and Air Required for the Combustion of 1 kg. of Carbon to CO_2 or CO.

percentages of carbon dioxide and carbon monoxide in the effluent gas are known. The ratio of the percentage of carbon dioxide in the gases to the total percentage of carbon-bearing gases, that is the carbon dioxide plus the carbon monoxide, multiplied by 100, is designated as n_v, so that

$$(2) \qquad n_v = \frac{\%CO_2}{\%CO_2 + \%CO} \times 100.$$

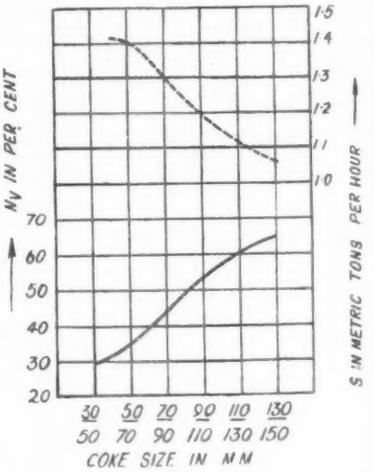


Fig. 17.—Influence of Coke Size on N_V and Melting Rate (S). (After G. Buzek and M. Czyzewski.)

Therefore, the value "n_v" may be considered as an index of the stage of combustion. If the volume of air required for combustion of one kilogram of carbon is plotted against the value of n_v for all stages of combustion from 100 per cent. CO (n_v = 0) to 100 per cent. CO_2 (n_v = 100), Fig. 14 will be obtained. The equation for the straight line relation in this diagram shows that

$$(3) \qquad L = 4.45 \times \frac{(100 + n_v)}{100}.$$

Returning for a moment to consideration of equation (1), it is noted that L appears in it. Making use of equation (3), a substitution may be made in equation (1) for L in terms of n_v

Melting in the Cupola

When this is done, the following equation results:—

$$(4) \qquad S = \frac{60}{10} \times \frac{W}{\frac{K \times k}{100} \times 4.45 \times \frac{100 + n_v}{100}}$$

By arithmetical manipulation this yields the next form:

$$(4a) \qquad S = \frac{60{,}000}{K \times k \times 4.45\,(100 + n_v)}.$$

This equation has long been accepted at face value. A part of this investigation sought to clarity the relationships that might exist between the various factors on the right-hand side of equation (4). What effect will a change in any of these variables have on S as well as the other factors in the equation? According to these investigators there is no connection between the blast volume (W) and the coke charge, or the kilograms of carbon consumed per 100 kilograms of iron ($\frac{K \times k}{100}$), since they can be changed independently of one another.

Furthermore, Jungbluth, Heller and Korschan believe that, with a constant coke charge, no relation exists between blast volume (W) and composition of the stack gas as represented by n_v. This would mean that the percentages of carbon dioxide and carbon monoxide in the stack gases do not change as blast volume is varied. In this they are supported by W. Hollinderbaumer[9] "within certain limits" and by E. Piwowarsky and F. Meyer[10] "with accurately measured coke charges and increasing blast volume." With constant coke charges and increasing blast volume, therefore, a purely linear relationship exists between melting rate and blast volume as shown in Fig. 15.

If n_v also remained constant with constant blast and increasing coke charges, then the melting rates would be inversely proportional to the coke charges. A close inspection of Fig. 15 reveals that this is not the case. Rather, as the coke charge is increased the melting rates are somewhat greater than would correspond to the inverse proportionality. A consideration of equation (4) shows that this is only possible if n_v decreases as the coke charge becomes heavier. Therefore, there is actually a connection between the coke charge and n_v. It is further evident from equation (4) that, with a knowledge of melting rate, blast volume, and coke charge, the relation between coke charge and n_v can be calculated. Systematic investigations by Jungbluth, Heller and Korschan permitted plotting of this relation (see Fig. 3). This curve, which has been called the n_v curve, is claimed by Jungbluth and Korschan to be the fundamental law that controls the entire cupola process. The relation can be stated mathematically as:—

$$(5) \qquad n_v = \frac{386.5}{\frac{K \times k}{100}} + 15$$

In view of the importance of this relation, an investigation was made to ascertain if it is quite generally applicable or varied by other influences. According to Jungbluth and Bruhl,[11] with due consideration to the deviations to be expected in experiments of this type, the diameter of the cupola is without effect on the course of the curve, at least for furnaces with diameters between 23½ and 51 in. A. Nahoczky[12] is also of the opinion that furnace diameter does not play an essential role.

Recently, G. Buzek and M. Czyzewski[13] investigated the influence of coke size on coke consumption in the cupola. From this investigation, information is available relative to the influence of coke size in n_v. The coke charge used was equivalent to 18.7 lbs. of carbon per 220 lbs. of iron (8.5 kg. C/100 kg. iron), and the sizes lie between 1.2 and 5.9 in. The values of n_v as computed from the original diagrams are plotted in Fig. 16. From this diagram it is immediately apparent that n_v definitely depends upon the size of coke. Therefore equation (5) is not generally valid, but is dependent upon this variable. It will be noted that the curve in Fig. 16, which originates from Jungbluth and Korschan's work, with coke of about 4.33 in. diameter and 7.08 to 7.87 in. length, passes between Buzek and Czyzewski's points for coke sizes of 3.54 to 4.33 in. and 4.33 to 5.12 in. This indicates good agreement between these investigators.

In the same investigation by Buzek and Czyzewski, it was established that, with a constant coke charge and blast volume, an increase in melting rate is observed with decreasing coke size and thus with decreasing n_v (Fig. 17). This would be expected, since, with a fixed coke charge and blast, the smaller coke sizes will burn more rapidly, presenting an increased surface area for reactions.

The elapsed time from charging to tapping is also strongly influenced by n_v. Doubling the coke charge, which will cause a decrease in n_v, results in an increase of only about 30 per cent. in the elapsed time. On the other hand, when blast and coke charge, hence n_v, are held constant and the weight per unit volume of the iron in the charge is doubled, by reducing the size of the pieces in the charge, the elapsed time required for a charge to pass through the cupola will increase by 55 per cent.

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[9] Hollinderbaumer, W., Die Giesserei—12, 1925, p. 486; the same, 12, 1925, pp. 645-648.

[10] Piwowarsky, E. and Meyer, F., Stahl und Eisen—45, 1925, pp. 1017-1022.

[11] Jungbluth, H. and Bruhl, E., "Der Zusammenhang zwischen Koksatz und Abgaszusammensetzung bei Kupolofen verschiedener Durchmesser" (The Connection between Coke Charge and Effluent Gas Composition in Cupolas of Different Diameters), Technische Mitteilungen Krupp—Forschungsberichte, No. 1, February, 1939, pp. 1-4.

[12] Nahoczky, A., Congres International de Fonderie en Pologne—No. 21, 1938, pp. 1-7.

[13] Buzek, G. and Czyzewski, M., Congres International de Fonderie en Pologne—No. 1, 1938.

(*Concluded from next column.*)

mined in January, 1941, compared with 22 tons in January, 1939, and 1940. This is due principally to conditions in Tonkin, the difficulty of finding proper maritime transportation, the difficulty of obtaining payment in sound currency, and a reluctance to sell to certain countries. The French armistice also has prevented the improvement of wolframite production, as various special types of mining machinery ordered from France were not received. Sino-Japanese hostilities have further affected production of wolframite, as a great number of experienced Chinese mine workers have returned to China. Native workers, who have replaced them, and who are not considered as good as the Chinese, are not giving satisfactory results. Future wolframite production and exportation is likely to be affected strongly by Japan's requirements and the Japanese desire to purchase the total production of this country.—(From a Report of the U.S. Department of Commerce, issued before Japan occupied French Indo-China.)

Indo-China Wolframite

The world's production of wolframite has been fluctuating in sympathy with international events, increasing during rearmament periods and decreasing when rearmament stopped. Total production, which was 1,700 tons in 1900, reached 32,000 tons during the world war, and averaged 11,000 tons during subsequent years. Of this amount, French Indo-China produced an average of 200 tons annually. China is the most important producer of wolframite, and supplies nearly 50 per cent. of the world's requirements. The other principal producing countries are Malaya, Australia, India, the United States, Bolivia, Portugal and Indo-China.

Tonkin is the only State in French Indo-China producing wolframite. Important deposits have been discovered, and several French mines have been established in the area. At the end of 1938 there were 224 mines in Tonkin, of which 49 were tin and tungsten mines. The mixed ore was formerly sent to France to be separated, but now this is done locally in a plant owned by the Société des Etains et Wolfram du Tonkin at Tinh-Tuc. Tin ore was formerly sent to the Straits Trading Company's smelting works at Singapore and Penang or to the Eastern Smelting Company, and the wolframite to Europe, principally France. Nearly 90 per cent. of Indo-China's total production of wolframite is supplied by group of French companies, including the Sociétés des Mines d'Etains du Haut Tonkin and des Etains et Wolfram du Tonkin.

Production of wolframite increased greatly during the world war; its metal content in 1917 and 1918 amounted to 247 tons. After 1919 prices dropped as the demand for wolframite fell off and new mines were opened in South China. As a result French mining companies abandoned production in favour of increasing production of cassiterite. In 1924 prices rose again and excited the interest of local mining companies, which produced 132 tons (87 tons metal content) in that year. From 1925 the total annual production increased, and reached its highest point in 1937 with 580 tons (389 tons metal content). The outbreak of the present European hostilities caused local production, which was 417 tons of wolframite (309 tons metal content) in 1939, to decline. In 1940 production dropped to 360 tons (208 tons metal content). According to official statistics, 18 tons of wolframite were mined in January, 1941. The mines are estimated as being capable of producing an average of 50 metric tons monthly.

Since September, 1940, the export trade in wolframite has been controlled by the Government General. All transactions relating to the sale of wolframite produced in the country must be effected by persons duly authorised by the Government. A special permit must be obtained to export wolframite. A special tax on exports of wolframite also has been established. The disruption of maritime communications has seriously affected the country's export trade in general. The few vessels calling at Indo-China ports when this report was written were mainly Japanese, with the exception of one American vessel every month, a few small Panamanian ships, and French vessels which sail now and then for France, Colonial ports, Manila and Shanghai. During 1940 exports of wolframite from Indo-China declined in quantity, compared with 1939, but remained nearly the same in value. About 40 per cent. of the ore was shipped to France.

Although the present international situation, which has increased the world's consumption of wolframite, and the discovery of new veins in Indo-China favour further development of local production and exportation, production has not improved. Only 18 tons of wolframite were

(*Continued in preceding column.*)

Mass Production and Maintenance of Quality

Informal talk by MR. J. FERDINAND KAYSER before the London Branch of the Institute of British Foundrymen, and the subsequent discussion emphasise the close limits of control which are essential and the decisive importance of uniformity and quality in mass production processes

Following the early proceedings of the meeting of the London Branch of the Institute of British Foundrymen on Thursday, July 3, MR. J. FERDINAND KAYSER, of Gillette Industries, Limited, gave a talk on this subject.

The PRESIDENT (Mr. R. B. Templeton), in introducing Mr. Kayser, said he had a well-established reputation in the steelmaking world long before he went to Messrs. Gillette. In Sheffield he was very well known indeed as one of the foremost people in that particular industry. He was now metallurgist with the very famous firm of Gillette Industries, Limited.

MR. J. FERDINAND KAYSER said he proposed to review two things which many people considered were completely divorced from one another, *viz.*, mass production and quality. It was usual to associate quality with craftsmanship and handwork and quite foreign to anything made by mass production methods. As a matter of fact, quality was the whole basis of successful mass production because if not present at every stage, the line broke down and there was no longer mass production.

First of all, a definition of mass production was necessary, and it was proposed to take the Irishman's course and indicate what it was not. Suppose a factory was producing 100 articles per week and utilising 1,000 work-hours to do it; if it increased the production to 100,000 articles per week and utilised some 1,000,000 work-hours, it was not mass producing. It was merely perpetuating what was probably an evil system. Mass production meant producing very cheaply and in large quantities. He did not propose to deal with the question of when one should initiate mass production, but obviously there must be a demand. Many considerations entered into that. In the first place, it was no good attempting mass production unless there was a great deal of money available and, also, it must not be thought that money could be saved on hourly rate of wages because it could not. Mass production called for the highest possible skilled workers, and in quantity. It also called for a certain number of unskilled workers. The skill must start right at the very top and it must go down almost as far as the machine minder—and the machine minder on a mass production line must be a really first-class minder because if anything went wrong and it was not observed at once, absolute chaos resulted. It might be said that specialists were required for mass production, but that was not really so because mass production always brought so many problems that the technicians anywhere near the top had to be able to cover an enormous field. The executives must understand their machines. In some works it was quite easy to separate the machine shop from the foundry and, indeed, to separate the fettling shop from the foundry. The heat-treatment could be separated from the other departments and everything may be working very nicely in its own water-tight compartment. That, however, did not ensure the perfection of mass production. There must be somebody, or rather many "somebodies," who were fully acquainted with the line from the beginning to the end.

Quality Paramount

There were many aspects of mass production, and the one to which stress would be given was quality. The word "quality" was often used in different senses. Very often people asserted that a nickel-chromium steel was of higher quality than carbon steel or that a heat-resisting cast iron was of higher quality than a plain grey iron. He proposed not to use the word "quality" in that way, because nickel-chromium steel might be no better than carbon steel for certain purposes. Similarly, for many purposes, heat-resisting cast iron might be no better than ordinary grey iron. If the word "quality" were used in that way, confusion with a particular criterion of efficiency would result. In the case of structural steel, the criterion of efficiency was, of course, measured in tons per square inch. If one was considering heat resistance, the criterion of efficiency was probably the commencement of the scaling temperature or the rate of growth at high temperatures, but that had nothing to do with quality. Probably anything was of good quality if it always had *uniform* properties. Of course, it might be postulated that castings that were always full of blow-holes were of good quality. If foundrymen could make castings and control the distribution of the blow-holes, there might be a big market for them, but the trouble was that blow-holes had a distinct tendency to appear where they were not wanted.

Uniformity Essential

In order to produce a good quality article, the first essential was uniformity. A user must be able to buy the same thing every time, and if it was proposed to produce by mass production methods, "uniformity" must be the watchword. That had been achieved in certain branches of the steel trade, and he was going to make a statement now which was probably a very bold statement indeed. Everybody was familiar with the name of Swedish steel, and from early youth would have heard that the characteristic of Swedish steel was that it possessed "body" or "guts." That was drummed into the speaker in his early days, and continued right up to the beginning of this war. He believed he knew exactly what "body" in steel was; it was nothing more nor less than uniformity.

Many manufacturers did not try to achieve uniformity because they did not seem to appreciate how important it was. A visit to a Swedish steelworks would reveal the care with which everything was graded. People in this country, however, seemed to be working with an inferiority complex, and to think that their only hope of competing with Swedish material lay in producing cheaply and disregarding everything else. Therefore there existed very large Siemens furnaces with everything being "chucked" in and anything coming out. The result was that the product was not uniform.

Mass production of articles right from the beginning involved that everything must be under strict control, combined with an assurance that one began with A and that that A was A exactly; also that A would give place to B and B would give place to C, and so on down the scale; there must be no variation anywhere.

Suppose a foundry wished to produce a certain grade of iron under mass-production conditions, involving that at 10 o'clock, 11 o'clock and 12 o'clock 10 tons of iron were required; then the management must always put into the cupola exactly the same quality and amount of raw material and always blow it with the same quantity of air for exactly the same length of time. There must be the same gas temperatures and all factors must be controlled.

Coincidently with this, there was the making of the moulds. It was not proposed to discuss the handling of the sand; the arrangement of the essential conveyors; how methods must be controlled by mechanical means; or the wide subject of moulding machines. Primarily there could be no such thing as repairing a mould in mass production work. If a pattern failed to strip, there was a breakdown in the mould; if that persisted, there would be a breakdown in the cycle, and the whole of the mass production would cease. Therefore, with mass production, the methods adopted just must not break down anywhere. If they did break down, it was the job of the technician to find out why. Was it the sand, was it the pattern, or was it the particular procedure or the particular behaviour of the moulding machine? Whatever it was, the technical staff must find out the remedy.

Heat-Treatment and Annealing

It was possible by careful control to ensure that the same heat treatment gave the same result every time. That might sound rather a simple thing to say, but the desired result was not always attained. He personally had been associated with probably millions of £'s worth of steel, and the whole bugbear had been with the heat treatment. Too often it was found that steel did not respond to the same heat treatment, and with real mass production, *i.e.*, articles turned out at least in thousands and probably hundreds of thousands or even millions, this becomes disastrous.

Having heat-treated the casting, it went to the machine shops. Assuming that the first operation involved grinding, there must be no hesitancy finding out how to clamp the casting in the machine. It might be necessary to cast on special bosses or projections so that it could be jigged instantaneously. It would be laid down "from above" what constituted a grinding operation. It might be a case of two passes and a specified thickness of 6 in. If the final thickness was 6¼ in., somebody must know the reason why. One must, in mass production, feed the castings, when machining, in such a manner that there were the same conditions every time. There must be the same number of passes and the same wheel speed so that the same results were obtained. The same obviously applied to all the machining operations. There must be no question of the casting being hard. Such things must be cut out. If it was a case of a speed, say, of 250 ft. per min., ⅛ in. depth of cut and a 16-in. traverse, these conditions must be the same yesterday and to-day and to-morrow and always, even a month ahead. They must be the same always. It was useless attempting to reduce the speed or altering any one of the conditions which had been laid down.

Inspection

Mass production work involved that the inspection must be virtually 100 per cent. of everything, because it brought in its train not only great advantages but equally disadvantages. If anything went wrong on the line and it was not detected at once, it would not be a case of a wasted casting; whatever the wasted part was there would be thousands of articles rejected. Therefore, the inspection must be thorough and continuous. There must be means of inspection all the way down the line, and the operations must be chosen so that they can be inspected as work proceeded.

Finally the result of carefully controlled mass productions was the obtaining of a high quality, cheap product. It was just as easy to

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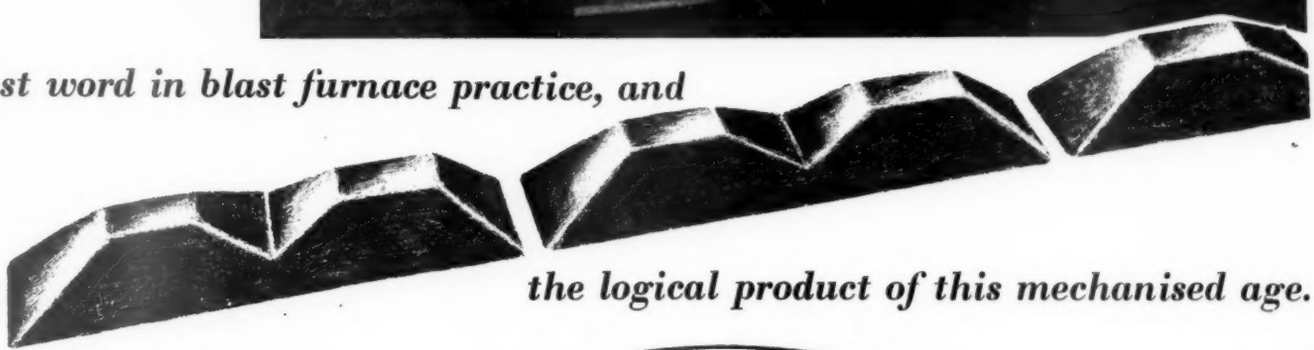

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Mass Production and Quality

make them all bad as all good, but there was no reason why they should not all be made good, and what was still more important, the work would have been produced by highly paid, high grade labour working under pleasant conditions.

DISCUSSION

The PRESIDENT (Mr. R. B. Templeton) remarked that, in speaking of uniformity, Mr. Kayser had struck probably one of the most fundamental truths in any industry. It was useless to produce an article one day which was entirely different from what had been produced the day before. In foundry work, absolute uniformity was a very difficult job, but it was what must be aimed at and what must be attained if their castings were to be used with any satisfaction by all the large manufacturers who were machining them on a mass production basis. The question of inter-departmental inspection had been mentioned, and that was a direction in which a great improvement in product could be effected. All foundries had their inspection departments for "passing" castings after they were made, but not always were the cores inspected before insertion in the moulds. There was very often great variation in cores from day to day, with the result that defective castings were made owing to faulty cores. If there were 100 per cent. inspection of cores, a very big source of loss would be prevented.

Reclamation

MR. V. C. FAULKNER (hon. secretary) recalled a remark made at the last meeting by Mr. Kain when he said that many of the benefits attributed to alloys were, in the long run, due simply to great care in processing, and added that this had a great bearing on what Mr. Kayser had just said. Mr. Kayser, however, had not touched on the very important question of the reclamation of defective castings. Personally, he once prepared a Paper for an International Welding Congress, in which he dealt with the reclamation of castings as undertaken by one of the large motor vehicle manufacturers. Surely, generally, mass production firms must pay great attention to that, and perhaps Mr. Kayser would say how reclamation of wasters fitted in with the general scheme of mass production.

MR. KAYSER replied that in mass production work the reclamation department must be absolutely separate from the mass production department. In his case there was a reclamation department in every line that was run. At the present time they were making many things besides razor blades, but the reclamation department in each case was absolutely divorced from the mass production itself. When anything went wrong and had to be reclaimed, it went down the line as scrap, and it was dealt with by a different personnel and different methods, and those engaged on the actual mass production did not know anything about it, although the reclaimed material got back into store later on.

DR. A. B. EVEREST said there was one point not referred to by Mr. Kayser which might be emphasised. It was that the mass production of of a large number of parts of consistent quality had a great deal to do with technical development, and that was particularly true of the foundry industry. The best example of that type of organisation to-day was the automobile industry, and certainly the reaction of that industry to the foundry industry had been one of advancement due to the necessity for uniformity. There was not a finer example of that than the case of piston rings, in connection with which one modern firm had gone to the extent of air conditioning the air blast, and they also ensured constant moisture, constant temperature, constant pressure, and so on.

Continuing, Dr. Everest said he would like to cross swords with Mr. Kayser in his reference to "guts" in pig-iron. Personally, he was quite sure that "guts" was the same thing as uniformity, and, moreover, he did not think it played such an important part in the iron foundry industry owing to the modern methods adopted, although it might be so in the case of steel. Uniformity, of course, assumed great importance in fabricating processes, because in that case it was perfectly obvious that quality of the material as well as uniformity of finish, etc., was essential. That applied particularly in the automobile industry. He had been particularly interested in what Mr. Kayser had said regarding watching the quality of materials from the very start upwards, as it was quite obvious that in mass production any breakdown in the line at any point was a most serious matter.

MR. KAYSER, commenting on what Dr. Everest had said, remarked that he would not for a moment argue with him about cast iron, because Dr. Everest knew so much more about that than he himself did.

MR. KAIN, after thanking Mr. Kayser for stressing the importance of quality and uniformity, asked what was meant when Mr. Kayser spoke of conditions being laid down "from above." On what lines did the people above lay down the standards, and where did they get the necessary knowledge for doing so? However highly experienced a man was in any particular industry, he thought it would be very difficult for him to lay down, straightway, the conditions of quality or inspection. Therefore, he would like to know how these conditions were laid down in the first place. Were they the result of trial and error, or were they the result of pure research or the result of a period of experimentation? It was very important to know how these fundamental principles of quality were laid down "from above," in the first place.

Control through Salesmen

MR. KAYSER replied that this was a particularly pertinent question, and he had not thought that anyone would raise it. As a matter of fact, the answer might surprise some people. The conditions of quality, in his view, should always be laid down by the salesmen. It did not matter what was being sold, because in the manufacture of any article it was always necessary to bear in mind where it finished up. In the case of the article he was particularly interested in at the moment, the razor blades finished right up with the user. In the case of these razor blades, his firm was particularly expensive. Indeed, everything they did was expensive, because so much money had been spent on buildings and plant and other things. Nevertheless, they easily met competition, and there were reasons for that. For instance, they laid it down that the heat-treatment temperatures must vary ± much less than anybody else's. They cut out certain machining operations, and these and other points were matters which were always discussed with the sales department and the chief technicians. The point always was to what close limits should they work, and should they cut out certain operations? They believed in cutting out early processes as much as possible, and, secondly, they always tried to work as close as possible, talking in lbs. Somebody was sure to ask him about the different qualities of razor blade, and how were they controlled. Well, they were controlled to a percentage of permissible scrap, and it was possible to do that in other things besides razor blades. It was done, for instance, with certain electric lamps with which he had been associated. He believed he was right in saying that certain electric lamp people, and probably most of the razor blade manufacturers, made two qualities. Certain cheap qualities were made which were never seen on the market in this country. The idea was that these could carry a certain percentage of scrap, but it must not be higher than a certain amount, say 5 per cent., just to take a figure. He would not say what the actual figure was in his own case! On the other hand, the endeavour was made, in the other quality, to produce the very best ever, and that meant testing to the highest degree possible with present-day methods. His firm was having certain castings made for them, and they were controlling them very closely. The dimensions were laid down and they had to be strictly adhered to, because the jigs were made to these measurements. In the same way, all the hot pressings used by his firm were worked to jigs and proof stress. The point was that the sales and technical departments must know exactly what they wanted, and then it was seen that they got it.

MR. PINCOTT said he had had experience of the mass production of castings for brake drums for the automobile trade, and he particularly agreed with what Mr. Kayser had said with regard to defective moulds. In the particular brake drum shop to which he referred, there was an average output of 50 to 60 tons per week, and although the shop was pretty well mechanised it often happened that defective moulds were sent to be cast up, the idea being to put it right later. The problem was to prevent the men doing this, and therefore it was arranged that the foreman should walk round and put his foot in the defective mould. Otherwise there was great interference with the mass production of the brake drums. As Mr. Kayser had said, mass production was not possible unless everything was working correctly, for if something went wrong there was serious trouble.

MR. KAYSER replied that apparently Mr. Pincott and himself saw eye to eye on everything. When he first joined a mass production firm he thought he would have nothing to do. It was true that whilst things went smoothly there was not a great deal to do but, unfortunately, things did not always go smoothly. The greatest horror was the trouble that righted itself and probably made its reappearance again later. No doubt it was often found in the foundry that a thing righted itself, but nobody had the remotest idea why.

Vote of Thanks

DR. A. B. EVEREST, proposing a vote of thanks to Mr. Kayser, said the talk they had had, and the discussion upon it, had emphasised in a striking manner the importance of uniformity and quality under mass production methods.

DR. JONES, who seconded, said that Mr. Faulkner was to be congratulated on having persuaded Mr. Kayser to come to the meeting and address them, because Mr. Kayser very rarely spoke in public and wrote less. Therefore, it was something of a "scoop" to have had him at this meeting. He was particularly fitted to speak on mass production. Having visited Mr. Kayser's works he had come away with a number of impressions, but the main one was that owing to the difficult conditions at the present time they were only producing about 10-million razor blades an hour! On the question of quality, he said he did not know if it had ever been settled how many fairies there were on a needle, but with his ultra fine and supersonic electroscope, Mr. Kayser tested every blade and knew exactly how many fairies there were on each edge (laughter). If they varied by ± 0.1 per cent., they were automatically rejected and sold on the Gold Coast!

The vote of thanks was given with hearty acclamation.

MR. KAYSER, acknowledging the vote of thanks, said he had most readily accepted the invitation to speak at this meeting, and it had been a great pleasure to him to come.

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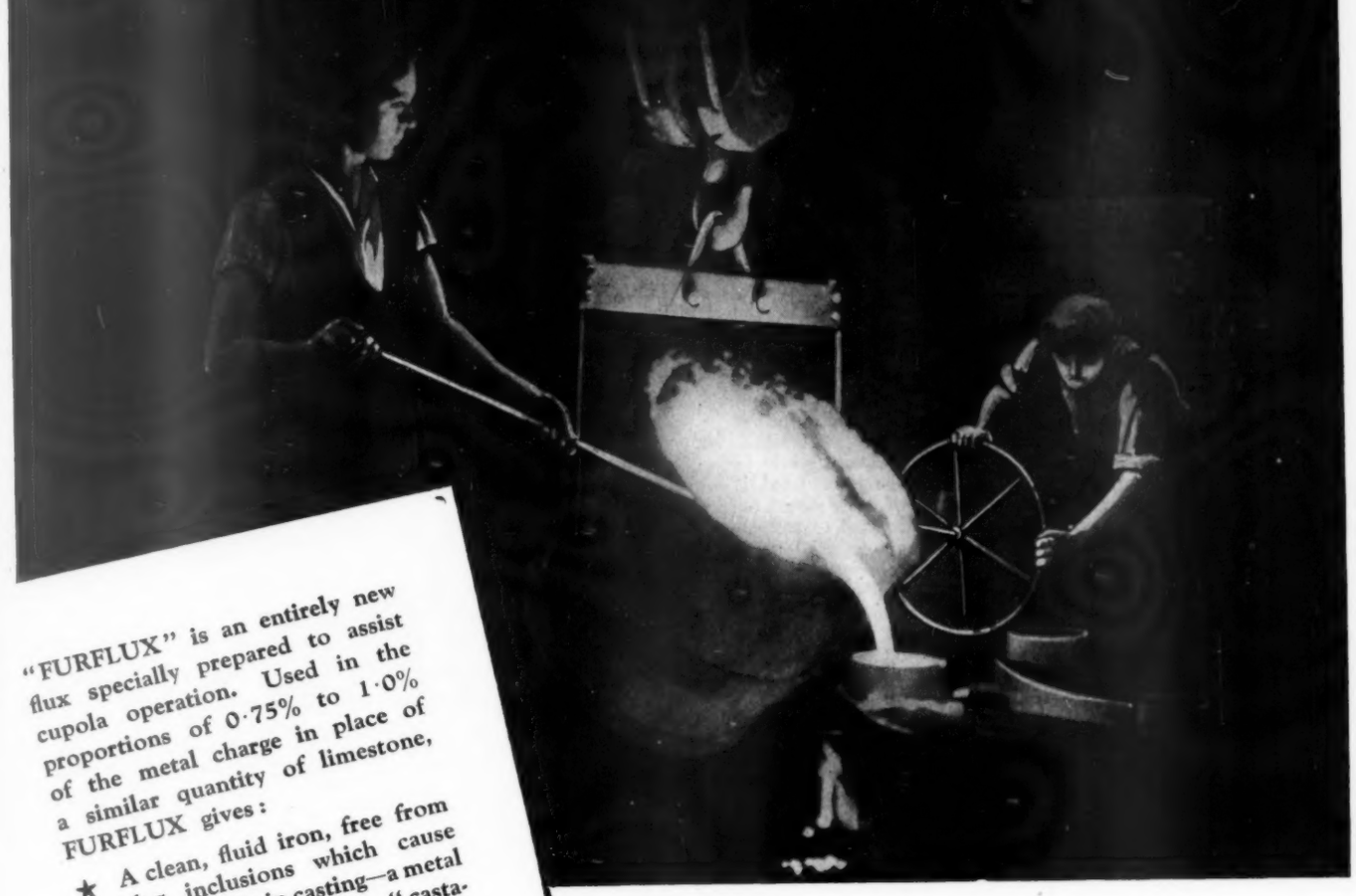

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Science and World Order

INTERNATIONAL CONFERENCE IN LONDON

During the week-end, September 26 to 28, the Division for the Social and International Relations of Science of the British Association held a Conference on "Science and World Order" at the Royal Institution in London, which was attended by an international gathering of statesmen, scientists and technologists. The Conference was opened at a preliminary meeting held at Burlington House on September 25, when Sir Richard Gregory, F.R.S. (President of the British Association), read an introductory address on the objects of the meeting, and leading foreign visitors were welcomed by members of the Government, including Mr. Anthony Eden (Foreign Secretary).

At the morning session on September 26, presided over by Sir Richard Gregory, a series of Papers was presented on the subject of "Science and Government," the majority of the speakers calling for a closer collaboration between administrative departments and scientific workers. Prof. A. V. Hill, M.P., Sec.R.S., discussed the use and misuse of science in government; Prof. L. Gulick illustrated large-scale planning at the hands of government by surveying the projects of the Tennessee Valley Authority for converting a vast arid region of the United States inhabited by millions of people into a more prosperous area, by the provision of energy and power on a large scale through the harnessing of the Tennessee River and its tributaries; Dr. P. W. Kuo presented an embracing survey of the promotion and application of science in the government of China. Dr. J. B. S. Haldane reviewed the different attitude shown by various governments to science, and referred to the extensive encouragement given to applied science in the Soviet Union. Prof. J. D. Bernal, in the course of his address, called for an acceleration in placing at the disposal of the public through government co-operation of the fruits of scientific research and invention, citing an American estimate that in the past the lag between the completion of an invention and its final enjoyment by the greater masses of the people was of the order of a century. In recent decades the pace of application had been quickened, but was in most cases still of the order of ten years, which Prof. Bernal thought should be at least halved, if not reduced to one year. Dr. A. Labarthe, editor of "La France Libre," speaking *extempore* in French, suggested that this gap between invention and application was maintained wide by the restraint shown by manufacturers and capitalists in sinking large sums for the exploitation of new discoveries, whose appeal and utility were still untried. The chasm between the fruits of research and invention and their application and universal adoption might be bridged by what Dr. Labarthe termed "usines laboratoires," which would transform a new invention from its laboratory and inchoate-applicable stage to a commercial proposition. Dr. J. Negrin, ex-Premier of Spain, and an eminent Spanish physiologist, dealt with science and statesmanship.

Science and Human Needs

The afternoon session on September 26, presided over by H.E. the American Ambassador, Mr. J. G. Winant, was devoted to the aspect of science and human needs, which was introduced by the chairman in a Paper emphasising that certain tasks in the economic field could only be satisfactorily accomplished by bodies representative of the entire world. These problems included access to raw materials, the building-up of backward areas and creating new markets and new understandings as to the production and distribution of staple goods, a common standard of living, the prevention of excessive fluctuations in the prices of certain basic products, extensive public works of an international order, and the co-ordination of international traffic. Sir John Orr, F.R.S., dealt with the rôle of food in post-war planning for human welfare, and Sir Harold Hartley, F.R.S., discussed world heat and power requirements and their social implications. The Rt. Hon. Herbert Morrison, P.C., M.P., read a spirited Paper on the need for planned social reforms on a world scale. The orientation of scientific research to war was reviewed by Dr. W. Penfield, of the National Research Council of Canada and President of the Royal College of Physicians and Surgeons of Canada.

Material Economy

Prof. A. C. G. Egerton, Sec.R.S., rounded off the session with a Paper on material economy, in which he maintained that in any recasting of the world order those things must have first consideration which make life possible. The two main considerations were the energy of radiation received from the sun and the energy needed by the individual which he receives as food and warmth. It is estimated that the mechanical power in use by man is not more than 100 million horse-power, and that the manual power employed, dependent on the energy of food, is not greatly less. The energy of fuels stored from solar radiation in past ages is used to supplement human labour, and so is an essential part of the scheme of material economy; the relation between the energy of foodstuffs and the energy of the fuel used determines in great measure the world's welfare. Dr. Egerton suggested that a closer watch should be kept on these matters and that those bodies responsible for guiding the world's statesmen on such matters should be reorganised and given greater powers to exercise this control.

The first session on September 27 was presided over by H.E. the Soviet Ambassador, M. Ivan Maisky, who addressed the meeting on the subject of "Science and World Planning," in which he sketched the broad outlook of the Soviet Union in planning ahead on a scale sufficient to meet future needs. He emphasised that the Soviet Union drew no distinction between pure and applied science; science as he understood it was true knowledge capable of practical application for meeting human needs. This session was graced with ten notable Papers on a variety of subjects, among which may be mentioned the contribution of Prof. A. Hansen, of Harvard University, on current researches in the U.S.A. on post-war problems, that of Prof. P. S. Florence on the distribution of industry and the population, and a Paper on giant power and world planning by Mr. H. P. Vowles.

Science and Technological Advances

H.E. the Czecho-Slovak President, Dr. Benes, presided over the afternoon session, devoted to "Science and Technological Advances." In his Paper, Dr. Benes reviewed what Czecho-Slovakia had done to promote scientific work and research during the twenty years of its independence, and sketched the fate of the technological institutions of the Republic since their occupation. Of the other Papers read by representatives from many countries forming the Allied front, notable contributions were those of Dr. C. H. Desch, F.R.S., on the conservation of natural resources, of Dr. J. H. de Boer on industrial research and the Universities, and several references to the question of the employment of raw materials and waste products which at present have no industrial or economic utility.

The last two sessions, held on September 28, and presided over by H.E. the Chinese Ambassador, Dr. Wellington Koo, and Mr. H. G. Wells, respectively, were devoted to "Science and Post-War Relief" and to "Science and Education." This successful meeting of the British Association, which was well attended throughout, and of which the whole of the Papers at the meeting will be issued in a special volume, terminated with a Declaration of Scientific Principles, emphasising the indispensability of intellectual freedom and international co-operation between scientific and technical workers for progressive human development, which was read by Sir Richard Gregory.

Uses of Strontium in Metallurgy

One of the principal uses of strontium and its salts is in the metallurgical industry, points out DR. M. S. KRISHNAN, of the Geological Survey of India, in Bulletin No. 3, Strontium Minerals, issued by the Survey. Small amounts of strontium added to copper act as a deoxidiser and purifier. The metal also prevents the formation of blow-holes in copper used for castings. Tin-strontium and lead-strontium alloy, containing 5 per cent. Sr and the rest tin or lead, is used as a cleanser in certain alloys like those of copper, tin, lead and zinc. Small amounts of Sr and tin are said to impart hardness and durability to the lead used in making storage batteries.

Strontium carbonate has been used in the steel industry. Added to the open-hearth charge, it acts as a flux and increases the fluidity of the slag at the same time reinforcing its basic character. It also removes excess sulphur and phosphorus in steel. It is used in Germany to produce special high-grade alloy steels. Extensive use of this material is prevented by the high cost of strontianite in comparison with lime (or alkali carbonate) which is commonly used for these purposes, but is not so efficient. In German practice, about 1 to 1½ per cent. by weight of strontianite is added to the furnace charge as soon as the charge melts. It has been suggested that very high-grade steel, containing only very small amounts of sulphur and phosphorus, can be produced in the open-hearth or electric furnace by using strontianite even if the pig-iron or scrap contains large amounts of these impurities.

A Watt Beam Engine Ceases Operation

The steam engine invented by James Watt that helped to make Birmingham the industrial hub of Europe has just ceased working after nearly 150 years of almost uninterrupted activity. The engine made by the firm of Boulton & Watt, of Soho Foundry, Smethwick, is of the beam type, such as was largely used in the early years of the last century, for pumping as well as for driving machinery.

Exactly when the engine was constructed, is not known. A Birmingham firm of toolmakers, Vaughan Bros., found it in position when they began business in their Dartmouth Street factory 103 years ago. Since then it has driven the machinery of the firm's drop-stamping shop, their rolling mill and their heavy fork hammers, with hardly a break except one of a few weeks when, 50 years ago, the engine cylinder cracked and the beam broke.

James Watt's steam engine is capable, it is said, of many years' activity yet. Unfortunately, Messrs. Vaughan Bros. are winding up their business. There is a possibility, therefore, that the engine may be offered to the Engineering Department of the University of Birmingham as a museum piece.

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The Week's News in Brief

Trade Talk

THE TRIPHASE FURNACE COMPANY, LIMITED, is being wound up voluntarily. Mr. Reginald Montgomery, Imperial Buildings, Rotherham, is the liquidator.

AT A MEETING held yesterday of the Keighley Association of Engineers, a lecture entitled "Some Problems of Mechanical Flight," illustrated by lantern slides, was given by Mr. Sidney F. Benson, B.Sc. (of Bradford), in the Victoria Hotel, Keighley.

THE KING has approved the removal from Buckingham Palace of certain sections of railings and gates as a contribution towards the national campaign for the collection of iron gates and railings to be converted into scrap. About 20 tons of metal, mainly castings, will be removed.

KEIGHLEY ASSOCIATION OF ENGINEERS announces the following changes in its officers:—President, Mr. N. S. Kilner, A.M.I.Mech.E., "Ashlea," Bradford Road, Bingley; Chairman of Council and Hon. Treasurer, Mr. W. Womersley, 35, Cark Road, Keighley; and Hon. Secretary, Mr. A. Connelly, 222, Skipton Road, Keighley.

"THE STANTONIAN" now lists the following among the principal officials of the Stanton Ironworks Company, Limited:—Spun Plant manager, Mr. J. Curtis; foundry superintendent, Mr. R. D. Lawrie; Stanton Foundry manager, Mr. T. Hobson; Holwell Foundry manager, Mr. G. R. Buckley; Riddings Foundry manager, Mr. C. V. Lineham; and chief chemist, Mr. W. Woodhouse.

ADDRESSING the Newcastle-upon-Tyne Area Committee of the Royal Society for the Prevention of Accidents, Mr. E. C. Greig, labour superintendent of the United Steel Companies, Limited, Sheffield, said that 80 per cent. of the accidents in factories were avoidable. The vast majority were due to the human factor, and could be substantially reduced by education, constant vigilance and attention to detail.

ENGINEERING TOOLS were sold or exchanged at an auction at Bristol last week, attended by representatives of firms in the South-West of England engaged in war production. The object of the auction was to attack bottlenecks in production. Firms sent their representatives with lists of tools they needed to fulfil urgent orders and of any tools lying idle for the time being. Some of the tools were sold, others lent. Similar auctions are to be held throughout the country.

THE MINISTRY OF WAR TRANSPORT announces that a new railway concession is now in operation to meet cases of employees who normally travel between their homes and their place of work on workmen's tickets or the like, and who by reason of the performance of Home Guard, Fire Guard, or other A.R.P. duties at business premises are prevented from travelling within the times covered by such tickets. On such occasions these people will be able to obtain return tickets valid for two days at the cost approximately of a single ordinary fare for the return journey. The necessary forms for signature by the employer or the Civil Defence Authority will be obtainable from the railway company concerned.

IN THE HOUSE OF COMMONS, MR. STOKES asked the Parliamentary Secretary to the Ministry of Supply whether he was aware that Landore Zinc, Limited, recently went into liquidation owing the Ministry of Supply £1,500; and whether he would state the reason why the Ministry became a creditor of this company. MR. HAROLD MACMILLAN stated in reply that the company was producing zinc by a special process, and the Ministry of Supply entered into contracts with the firm to secure production on terms which it was considered would enable the company to continue its operations. The company was, however, unable to meet its liabilities from this and its other operations, and it went into voluntary liquidation. Pending the receipt of certain outstanding claims, the exact position between the Ministry and the company could not be ascertained, but it appeared unlikely that the amount owing to the Ministry was as stated in the question.

MR. ERNEST BEVIN, Minister of Labour, addressing members of the Institution of Production Engineers at a luncheon in London last Friday week, over which Mr. G. E. Bailey presided, asked every one responsible for production to turn his attention to getting the greatest possible use out of our total available skill. The differences in achievement in this direction were very striking. The ratio of skilled people to trainees and others in one works doing the same operation might be much larger than at another, and it was essential to establish a standard that would guide the inspectors. This was an aspect of the problem which production engineers might profitably consider. In the case of the Air Force, really a wonderful accomplishment had been revealed. They had built up their great servicing branch on a very low proportion of skilled journeymen, and if industry had done as well as that Force, the skilled personnel problem at this moment would have been pretty well solved.

AS A RESULT OF A MEETING of Sheffield and district employers in the steel and engineering industries, and a resolution and letter sent to the Prime Minister, Sir William Beveridge, on behalf of the Government, paid a visit to Sheffield and met a representative body of employers. The meeting was held with a view to obtaining information as to the labour situation, and the effect of Government policies in regard to the calling up of men, the transfer of labour, and the allocation of manpower generally, and as to the best method of allocation to obtain the maximum production necessary in all branches. Sir William undertook to report the proceedings fully to the Government. Members of Sheffield and District Engineering Trades Employers' Association have complained that removal of men to other jobs, calling up of men to the Forces, and changes in the list of reserved occupations have caused labour shortage in works engaged on war production. They have also expressed concern at the disturbances caused by the conflicting man-power policies of Government departments and confusion in attempts to carry these out.

Personal

MR. H. A. REINCKE has resigned from the board of William Beardmore & Company, Limited.

DR. W. H. MILLS, F.R.S., has been elected president of the Chemical Society until the next annual general meeting.

MR. I. A. R. STEDEFORD, managing director of Tube Investments, Limited, has been elected a director of Stewarts and Lloyds, Limited.

MR. ROBERT J. NORTON, a director of Petters, Limited, of Yeovil and Loughborough, has, for health reasons, retired from active duty with the company after 25 years' service.

MR. F. F. PLANT, chief engineer of the Settle Speakman group of collieries, has received a presentation from the officials and workmen of the Stafford Coal & Iron Company, Limited, on the occasion of his leaving the company.

MR. JOHN GREEN, a local director of Thomas Firth & John Brown, Limited, Sheffield, has joined the board of the Iron Trades Employers' Insurance Association, Limited. Mr. Green is chairman of the Yorkshire region of the Engineering and Allied Employers' National Federation, and president of the Sheffield Lighter Trades Employers' Association.

Wills

FAIRGRIEVE, J. G., steelworks manager, of Colvilles, Limited	£6,002
CROSSLEY, ALBERT, works director at Sheffield of the English Steel Corporation, Limited ...	£20,984
EYRE, HARRY, of Sheffield, for 50 years with Turton Bros. & Matthews, Limited, steel manufacturers	£3,116

Obituary

MR. WILLIAM PINNINGTON CORDEN, a director of the Vaughan Crane Company, Limited, Openshaw, died on September 28, aged 55.

MR. ROBERT BERTRAND JACKSON, a director of the Millom & Askam Hematite Iron Company, Limited, and of the North Lonsdale Iron & Steel Company, Limited, died recently, aged 69.

MR. EDMUND STIRK, joint managing director of the Halifax firm of John Stirk & Sons, Limited, tool makers, has died at the age of 72. Mr. Stirk was a past-president of the Halifax Engineering Employers' Federation.

Law Report

Leaving Work without Authority

A prosecution of considerable importance was heard at Burnley Police Court on September 26, when Albert Heyslop (18), of Leaver Street, Burnley, was summoned for failing to comply with a direction given on behalf of the Ministry of Labour and National Service in respect of employment.

Mr. H. Ogden, prosecuting for the Ministry, said that by a section of the Act under which the proceedings were taken, the Ministry of Labour could direct any person in the United Kingdom to perform work which he was capable of performing. In the particular case the defendant commenced work as a drawer at Bank Hall pit in November, 1938, and continued in the capacity until January, 1941, when he left without notice and started work as an engine cleaner with the L.M.S. Railway Company. In March, 1941, directions were given him to resume his original employment in the pit, and he produced a doctor's certificate to the effect that he was unfit for such work. On receipt of the certificate its effectiveness was questioned by the Ministry for the reason that Heyslop had to submit himself for medical examination in order to obtain work with the railway company, a serious test being insisted upon. An independent medical examination was accordingly ordered. The doctor agreed that the youth was unfit to undertake any occupation underground, but found that he was fit to take on any class of work above ground. Fresh directions were then issued calling upon Heyslop to work at the pit surface. Defendant appealed, but the Appeal Board dismissed the appeal on its merits, and new directions were given him by the Ministry to take employment as a pit surface worker. These instructions the defendant failed to carry out.

Mr. J. R. Illingworth, who represented defendant, contended that the latter had never claimed to be allowed to act as a dictator of where he should be employed. What he did say was that his health dictated what work was most suitable for him. The boy quite properly left his employment because he was not fit to work underground, and found more suitable work with the railway company. Mr. Illingworth submitted that the defendant had not failed to comply with the Ministry's order, as he was awaiting a reply from the Divisional Officer to an appeal that he had made.

Defendant gave evidence, and said his medical condition was the only reason he had refused work at the pit.

The magistrates found the case proved against the defendant, and imposed a fine of 20s.

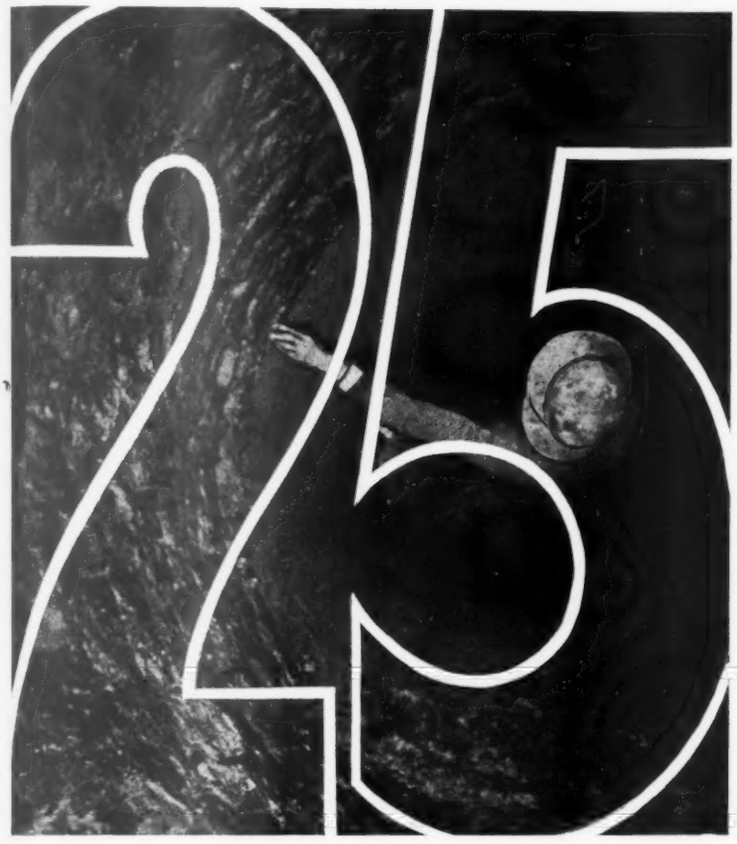
Contracts Open

Alnwick, October 25—Provision and laying of approx. 730 yds. of 4 in. dia. spun iron and 530 yds. of 3 in. dia. spun iron mains, etc., for the Rural District Council. Mr. C. M. Farrell, surveyor, Old Court Buildings, 34, Green Batt, Alnwick. (Fee £2 2s.)

Plymouth, October 11—Supply and erection of 7½-ton hand-operated overhead travelling crane, for the Town Council. The City Electrical Engineer, Armada Street, Plymouth.

Sheet Metal Industries Association

The first meeting of the Sheet Metal Industries Association was held at Manchester recently, Mr. R. F. Taylor presiding. This new organisation has been formed by firms engaged in the fabrication of sheet metals, ferrous and non-ferrous, for the advancement of the industry, and branches are in process of formation all over the country. The complex problems relating to production and finance now facing employers in this sphere will not be lessened in the post-war era, and there has arisen a demand for an organisation to foster the resources of the industry—resulting in the formation of this Association. At the first meeting a Paper on "Sheet Metal as an Engineering Material" was given by Mr. Alastair McLeod. An executive committee was formed, composed of the following, with power to co-opt:—Mr. C. S. Cowap (Fielding & Sons (Werneth), Limited, Oldham), Mr. James Hilton (Hilton & Son (Leigh), Limited), Mr. H. E. Hendrix (Metal Containers, Limited, Ellesmere Port), Mr. R. R. Stockfis (Robert R. Stockfis (Manchester), Limited), Mr. R. F. Taylor (A. V. Roe & Company, Limited, Chadderton). The secretary is Mr. J. F. H. Templer, 11, St. George's Place, Southport.



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Raw Material Markets

Raw materials for the makers of light castings continue to be delivered promptly and in sufficient quantity to meet the restricted needs of the trade. High-phosphorus iron is largely used in this industry, and licences issued for this type of iron easily satisfy requirements. Demand for light castings shows no sign of improving, and few works' order-books are sufficiently well filled to enable plant to operate to capacity. Heavy castings, of course, are fully absorbed by Government and other important specifications, and the flow of deliveries of raw materials to makers is nothing like so free as in the case of the light foundry trade, as low-phosphorus and hematite irons, which are in short supply, are required for the manufacture of heavy iron castings. Difficulties in many instances have been overcome, however, by the substitution of high-phosphorus iron and other materials in furnaces.

Pig-Iron

MIDDLESBROUGH—There is insistent pressure on local ironmakers for supplies of pig-iron for the steel industry, with the result that output of Cleveland foundry iron has been reduced to negligible proportions. Before the war furnaces on the North-East Coast not only met in full the needs of foundries in the vicinity, but also those of foundries in other districts, including Scotland. It so happens that ironworks in the Midlands have been able to step into the breach and fulfil the commitments of the Cleveland works in full. Most consumers of foundry iron have booked their needs up to the end of the year, which is as far ahead as they are permitted to go by the authorities. Trade in all departments of the engineering industry is very active, with the exception of the light-castings branch, which remains rather poorly situated for new orders.

Owing to the short supply of hematite the number of uses to which this material may be put has been appreciably reduced, and many consumers are incorporating refined and high-phosphorus irons in their mixtures. Steelmakers are absorbing large quantities of basic iron, but ample supplies are forthcoming, while there is just about sufficient ferro-manganese to satisfy the needs of the steelworks.

LANCASHIRE—With certain exceptions, the demand for pig-iron in this area is no more than moderate. Lively conditions are ruling in the sections employed on work of urgent national importance, *viz.*, the heavy electrical, machine-tool and other heavy engineering works, but activity in the light-castings branch is at a greatly reduced level, owing to the limitations on outlets imposed by the war. Some jobbing foundries, too, are quietly employed. Licences for iron have been issued for supplies up to the end of the year and most buyers have booked accordingly.

MIDLANDS—Consumers of high-phosphorus iron, of which the light foundry trade is the chief user, have no difficulty in getting all they require and stocks are on hand at many points. This iron is also wanted more freely for other trades, owing to the relative scarcity of low-phosphorus iron and hematite. Supplies of these better quality irons are reserved largely for consumers who cannot make do with a substitute. The demand for products of the heavy engineers is maintained and is strong enough to ensure full-scale operations. Light-castings makers, on the other hand, have not a lot of work in sight and would welcome any opportunity to take a larger share in the war effort. At present, however, there is little likelihood of any change in this respect.

SCOTLAND—Immediate needs of pig-iron are being met in full, but consumers have had little opportunity for accumulating reserve stocks. Heavy engineers are the largest consumers, as they are fully engaged on a wide range of products under contracts placed by Government departments, whereas the light-castings section has not been called upon to any extent to supply the products needed to further the war effort, owing to the unsuitability in most instances of their plant. Ironworks in the English Midlands are delivering all the high-phosphorus iron asked for by the light foundries. Hematite is wanted in much larger tonnages than are currently being despatched.

Coke

No change has been made in the price of foundry coke, which, for delivery to Birmingham and Black Country stations, is 62s. 9d. per ton. Large stocks are held by many users, while ample supplies are on hand to meet fresh needs and no delay in transport is experienced.

Steel

The desirability of keeping at a low level imports of steel from the United States is making greatly increased demands on the resources of British makers. The requirements of the war machine are vast, and can only be satisfied by the curtailment of production of grades of steel for purely civilian purposes. This, generally speaking, has now been accomplished, and the additional capacity available for the manufacture of steel for the needs of Government departments has enabled home producers to play a still larger part in meeting orders directly associated with the war effort. Closer attention is now being paid to the production of alloy steels and steel ingots, which are widely utilised in the aircraft and munitions factories, while shipbuilders are getting better deliveries of steel for their vital contracts.

Scrap

Deliveries of scrap metal to most consuming points are not below requirements, but certain qualities are in rather short supply. On the whole, however, the position is satisfactory, and some works have accumulated stocks, which should prove of inestimable value later in the year. There are occasional instances of firms temporarily suspending deliveries, but in the main the call is for more and more scrap, as, in view of the falling off of imports, it is all the more necessary to conserve our own resources.

Metals

COPPER—The Prime Minister has now stated definitely that copper is among the commodities which the Soviet Union requires Great Britain to send her. Whether or not raw metal will be despatched it is not known, but it seems probable that finished and semi-finished goods will be sent. It certainly will not be easy for us to deliver to Russia large quantities of the red metal, as nearly all we receive is being promptly absorbed for urgent contracts, while the Control authorities do not permit copper to be used for ordinary civil purposes except in cases of necessity. However, it may be expected that special steps will be taken to assist the U.S.S.R. in respect of copper supplies.

TIN—There has been a resumption of tin purchases on Russian account in the East and prices have advanced, which is naturally regretted by American interests. The London tin market has been steady, with demand only moderate. Smelters have been offering forward metal, which was fairly well absorbed. The Malayan quota for tin production for the fourth quarter of the year has been fixed at 100 per cent. of the domestic assessments.

According to the Statistical Bulletin of the Tin Research Institute, world production of tin in August is estimated at 21,300 tons, compared with 18,400 tons in August, 1940. Production for the first eight months was 168,600 tons in 1941, against 143,500 tons last year. United States deliveries totalled 13,625 tons in August, against 12,575 tons in July. U.S. deliveries in the first eight months were 106,572 tons, compared with 70,404 tons in the corresponding period of 1940. Tin consumption of the United Kingdom was 2,418 tons in July, against 2,426 tons in June and 2,756 tons in July, 1940. World stocks of tin, including smelters' stocks and carry-over, decreased by 5,438 tons during August to 50,864 tons at the end of the month. Stocks at the end of August, 1940, were 51,232 tons.

Tin prices on the London Metal Exchange during the past week have been as follow:—

Cash—Thursday, £256 to £256 5s.; Friday, £256 5s. to £256 10s.; Monday, £256 to £256 5s.; Tuesday, £256 to £256 5s.; Wednesday, £256 to £256 5s.

Three Months—Thursday, £260 15s. to £261; Friday, £260 5s. to £260 10s.; Monday, £260 10s. to £260 15s.; Tuesday, £260 5s. to £260 10s.; Wednesday, £259 15s. to £260.

SPELTER—The shortage of spelter in this country is not so great as to hold up work on war contracts, but much more metal could certainly be readily put into consumption. Zinc supplies are tight all round; America, although sending metal to Great Britain, is herself in need of larger tonnages, while the fact that Japan has been willing to pay exhorbitant and fancy prices for supplies is a sure indication that the position in the East is far from happy. There have been other instances also of business in zinc being conducted at prices very much above those ruling in the United Kingdom. In view of our own need for additional supplies of spelter, it is somewhat puzzling that more widespread use has not been made of our scrap brass resources. It would seem that it is now much more in the national interest to utilise brass scrap as a measure of economy in spelter than in recovering the copper content found in the metal.

LEAD—It is necessary for lead consumers to obtain a licence from the Control before attempting to buy fresh supplies, but this presents less difficulty than in the case of other non-ferrous metals. In the first place, the metal is not playing such a vital part in the war effort as others, while the supply position is eminently more satisfactory. Lead pipes and sheets for the building trade remain quiet, and this factor alone makes a big contribution to the desultory conditions prevailing in the normal peacetime outlets of lead. On the other hand, fairly substantial orders of an urgent character are regularly coming the way of the cable and battery manufacturers, who are absorbing large quantities of lead. While it is true that non-essential lead consumers are receiving licences, the Control are not issuing permits indiscriminately; lead is being used as a substitute for other metals in certain processes, and it may be that further expansion in this respect will enhance the value of our lead resources in the future, so that to make extravagant use of the metal now would be folly. Purchases from Canada and South America are easing the tight lead position in the United States; deliveries from South America also mean that there is less lead available for Japanese buyers. The U.S. Government has imposed full priorities on the use of lead and producers are required to contribute to a defence pool.

Reports and Dividends

Cowans Sheldon—Dividend of 10% (same).

G. D. Peters & Company—Interim dividend of 7½% (same).

James H. Lamont & Company—Interim dividend on the ordinary shares of 7½% (5%).

Murex—Final dividend on the ordinary shares of 10% and a bonus of 2½%, making 20% (same).

Rio Tinto Company—Half-year's dividend of 2s. 6d. per share on the 5% preference shares.

Associated Portland Cement Manufacturers—Interim dividend of 2½% on the ordinary stock (5%).

Churchill Machine Tool—Interim dividend of 15% on account of the year ending December 31 (same).

W. H. Dean & Son—Net profit for the year to August 15, £35,050 (£37,464); ordinary dividend of 20% (same).

Humber Graving Dock & Engineering—Net profit for the year to June 30, £6,211; dividend of 4% for the year.

Hardypick—Net profit for year to June 30, after allocations to staff fund and reserve fund, £2,408 (£5,596); ordinary dividend of 10% (same) and a bonus of 2½%; forward, £6,131 (£9,147).

Thos. Firth & John Brown—Interim dividend on the ordinary shares of 4½% (10.8d. per share), free of tax, on account of the year ending December 31, 1941 (6% (1s. 2.4d. per share), free of tax).

International Diatomite—Directors are unable to recommend a dividend for the year to March 31, 1941. Expenses, £1,390; provision for taxation no longer required, £611; forward, £379 (£1,518).

Kay & Company (Engineers)—Net profit for the year to May 31, after crediting additional tax reserve of £11,000 made last year, £13,615 (£10,503); to employees' fund, £500 (£1,000); to tax reserve, £6,000; dividend of 12½% (same); forward, £2,974 (£2,734).